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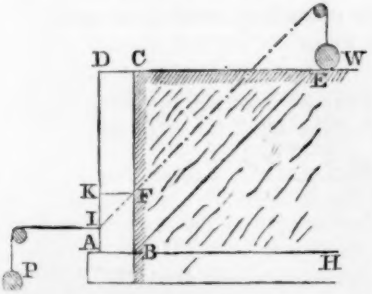
CIVIL ENGINEERING.

Remarks on Barlow's Investigation of "the Pressure of Banks and Dimensions of Revetments." *By* D. P. Woodbury, Lt. U. S. Engineers.

Barlow's "Treatise on the strength of timber, cast iron, and other materials," is a work of great merit, embodying a vast amount of information of the utmost importance to all engineers and builders.

It is a work too, we believe, extensively used both in England and in this country; and this fact, we trust, will justify the purpose of this paper, that of pointing out some errors in that author's investigation of "the pressure of banks and the dimensions of revetments."

From the fourth edition (London,1 837,) page 196 and subsequent, we make the following extract:



"Let C B H E (in the annexed figure) denote a bank of earth, the natural slope of which is E B.—Let the weight of the part C B E, one foot thick = W, and make B E = l, C B = h, C E = b. From the theory of the inclined plane,

as $l : h :: W : \frac{h}{l} W = W'$,

the weight which, attached to the centre of gravity of the sliding solid, would preserve it in equilibrio on the plane E B, supposing no friction between the two surfaces. The weight W' will, therefore, under this supposition, denote the quantity, F I the direction, and I the effective point of application of the force of the bank against the wall A B C D. And now, to find the horizontal force at I: since the triangles K F I and B E C are similar, we have by the resolution of forces

$$l : b :: W' : \frac{b\,W'}{l} = \frac{b\,h\,W}{l^2},$$

for the horizontal effect at I: also, since K A, from the nature of the centre of gravity $= \frac{1}{3}$ of D A, or $\frac{1}{3}\,h$;

$$\text{and K I} = \frac{h\,x}{b}, \text{ and A I} = \tfrac{1}{3}\,h - \frac{h\,x}{b},$$

(x being taken to denote the breadth of the wall at bottom,) the whole effect of the above pressure to turn the wall as a lever about a fulcrum at A, will be expressed by

$$\left(\tfrac{1}{3}\,h - \frac{h\,x}{b}\right)\frac{b\,h\,W}{l^2}, \text{ or } \left(\tfrac{1}{3}\,h - \frac{h\,x}{b}\right)\frac{b^2\,h^2\,S}{2\,l^2},$$

S denoting the specific gravity of the earth.

"Now, to find the dimensions of the revetment requisite to keep this force in equilibrio, let h' denote the given height of the wall; S its specific gravity, or the weight of one cubic foot; x, as above, the thickness of the wall at the bottom; y the distance of the perpendicular, let fall from its centre of gravity upon its base, from the outward edge of the wall at bottom, viz. the point about which the wall turns; and a the area of its transverse vertical section; then, since we are only considering one foot in length, the same quantity, a, will also denote the solid content of the wall opposed to the bank; and, consequently, a S will be its weight."

"Therefore, by the preceding proposition

$$F = y\,a\,S,$$

the resistance which the wall opposes in consequence of its weight, and

$$F' = C\,x^2,$$

the resistance from cohesion, C being a constant quantity, $\frac{1}{10}$ of which we may take $= 500$ as in the preceding article; whence

$$y\,a\,S + C\,x^2$$

will be the whole resistance opposed to the bank; and, consequently, in case of an equilibrium, or of an equality between the force of pressure of the bank and the resistance of the wall, we shall have

$$y\,a\,S + C\,x^2 = \frac{b^2\,h^3\,S}{6\,l^2} - \frac{b^2\,h^3\,S\,x}{2\,b\,l^2};$$

a general formula, from which x, the breadth of the wall, in all cases may be determined."

This investigation begins with the supposition that the prism of

earth, of which B C E is the transverse section, tends, under the action of its own weight, to descend along the natural slope B E, without any resistance from friction. Now the moment we discard the effect of friction, in other words suppose it zero, we endow the embankment with the characteristic of a fluid; so that its pressure against the back of the wall should be the same for all directions of the line B E, and equal to that of a fluid of the same specific gravity.

We might assume this as known à priori, but we arrive at the same conclusion by a direct examination of the forces.

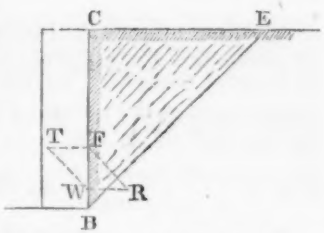
We may regard the prism B C E as a wedge, impelled by its own weight, against the planes B E, B C, and determine, on the principles of the wedge, the pressure on the surface B C; or we may regard that prism as a weight tending to slide down the inclined plane B E, and determine, by the theory of the inclined plane, the horizontal force, or reaction of the wall, necessary to prevent the descent.

In either view the forces acting are:

(1.) The weight of the prism = W, in a vertical line;

(2.) The pressure upon the inclined plane = R, perpendicular to B E;

(3.) The pressure upon the back of the wall or *the thrust* = T, perpendicular to B C.



The first is kept in equilibrio by the reaction of the other two. The three, regarded as emanating from F (B F = ½ B C,) are represented, in magnitude and direction, by the sides of the triangle T W F, similar to the triangle BC E since the sides of the first are respectively perpendicular to those of the last. In the triangle T F W we have F W = W; T W = F R = R; and F T = T. And we have, by similarity of figures

$$C\,E : W :: B\,C : T = \frac{B\,C}{C\,E}\,W = \frac{h}{b}\,W = \tfrac{1}{2}\,s\,h^2,$$

since $W = \frac{1}{2}\,s\,h\,b$. This expression for *the thrust* is independent of the direction B E, or of the natural slope, and exactly equal to the pressure, on a vertical surface of the height of h, caused by a fluid whose density is represented by s.

The particular error of Mr. Barlow consists in partially neglecting the reaction of the inclined plane. He resolves W' into two components, the first horizontal, the second vertical; whereas the second should have been perpendicular to B E, so as to be neutralized by the inclined plane. There is nothing to neutralize the discarded vertical component, which is, in fact, so much remaining weight, whose agency in the thrust is still to be determined, whose value is $W' \frac{h}{l}$, whose pressure on B C is

$$W' \frac{h}{l} \times \frac{h}{b} = \frac{h^2}{l^2} \times \frac{W h}{b} = \tfrac{1}{2} s h^2 \times \frac{h^2}{l^2};$$

and this is the exact measure of the error. Adding this to the expression for the thrust given in the foregoing extract, we have

$$\tfrac{1}{2} s h^2 \frac{b^2}{l^2} + \tfrac{1}{2} s h^2 \frac{h^2}{l^2} = \tfrac{1}{2} s h^2 = T;$$

as already obtained. The error we remark is more than half the thrust so long as the natural slope is steeper than 45°.

By a singular coincidence this error, tending to correct the hypothesis of no friction, renders the relation

$$T' = \frac{b h W}{l^2} = \tfrac{1}{2} s h^2 \frac{b^2}{l^2} = \tfrac{1}{2} s h^2 \sin.^2 a;$$

(in which a represents the angle between the natural slope and a vertical) a pretty good practical formula for *the thrust*, as will soon appear.

When friction is taken into view, the horizontal force necessary to prevent the descent of any weight W down a plane whose inclination to the vertical is represented by v, is given by the formula

$$F = W \left(\frac{\cos. v - f \sin. v}{\sin. v + f \cos. v} \right)$$

(See bottom of page 5, Journal Fr. Ins. Jan. No. 1843; or any work on mechanics which gives that force,) in which f is the ratio of friction to normal pressure. In the case of earth, a still representing the complement of the natural slope, we have $f = \cot. a$. Hence, dividing throughout by sin. v

$$F = W \frac{\cot. v - \cot. a}{1 + \cot. v \cot. a} = W \tan. (a - v) = \tfrac{1}{2} s h^2 \tan. (a - v) \tan. v.$$

To obtain the greatest possible value of this expression it is only necessary to divide the angle a into two such parts that the tangent of one multiplied by that of the other shall give the greatest product. Let d be the half difference between the two angles. Then

$$\tan. (a - v) \tan. v. = \tan. (\tfrac{1}{2} a + d) \tan. (\tfrac{1}{2} a - d)$$

$$= \frac{\tan. \frac{1}{2} a + \tan. d}{1 - \tan. \frac{1}{2} a \tan.} \times \frac{\tan. \frac{1}{2} a - \tan. d}{1 + \tan. \frac{1}{2} a \tan. d} = \frac{\tan.^2 \frac{1}{2} a - \tan.^2 d}{1 - \tan.^2 \frac{1}{2} a \tan.^2 d} =$$

$$= \tan.^2 \tfrac{1}{2} a + \left(\frac{\tan.^2 \frac{1}{2} a - \tan.^2 d}{1 - \tan.^2 \frac{1}{2} a \tan.^2 d} - \tan.^2 \tfrac{1}{2} a \right) =$$

$$= \tan.^2 \tfrac{1}{2} a - \tan.^2 d \left(\frac{1 - \tan.^4 \frac{1}{2} a}{1 - \tan.^2 \frac{1}{2} a \tan.^2 d} \right)$$

The fractional factor of the last term is always positive; it is therefore clear that the greatest value results from $d = o$; hence

$$F = T = \tfrac{1}{2} s h^2 \tan.^2 \tfrac{1}{2} a;$$

a result given in many works; see particularly Poncelet on Revetments, a translation by Capt. Sanders of a part of which is published in this Journal, commencing in the January No. for 1843, already cited.

It supposes the earth to be without cohesion or adhesion and without friction upon the back of the wall, but takes into view the friction of earth upon the slope of descent; and on these suppositions there is no doubt of its accuracy. Now let us compare this theoretic thrust with Mr. Barlow's practical thrust, or

$$T = \tfrac{1}{2}\, s\, h^2 \tan.^2 \tfrac{1}{2}\, a, \text{ with } T' = \tfrac{1}{2}\, s\, h^2 \sin.^2 a,$$

We see that the last is always the greatest. The ratio of the practical to the exact is the coefficient of stability. This ratio or coefficient is

$$k = \frac{T'}{T} = \frac{\sin.^2 a}{\tan.^2 \tfrac{1}{2}\, a};$$

For very small values of a we have, sensibly, sin. $a = 2$ tan. $\frac{1}{2}\, a$, or $k = 4$; and when a is nearly 90°, we have, sensibly, sin. $a =$ tan. $\frac{1}{2}\, a$, or $k = 1$.

We give a few intermediate values:

$a = 35°$ . . $k = 3.31$	$a = 55°$ . . $k = 2.48$
$a = 40°$ . . $k = 3.12$	$a = 60°$ . . $k = 2.25$
$a = 45°$ . . $k = 2.91$	$a = 65°\ 32'$. $k = 2.$
$a = 50°$ . . $k = 2.70$	

We see that Mr. Barlow's coefficient of stability is too small for very fluid earths, that it is too great for very stiff earths, that for common earths whose natural slope is about 35° ($a = 55°$) this coefficient being nearly 2.50 is about right since the cohesion of masonry is also taken into view, and that the formula is abundantly safe as a practical guide.

But in the application of this formula to the determination of the thickness of sustaining walls, another error is committed which we shall now proceed to notice—an error more serious since its tendency is to diminish the thickness of the wall.

Simple inspection of the general formula.

$$y\, a\, S + C\, x^2 = \frac{b^2\, h^3\, s}{6\, l^2} - \frac{h^2\, h^3\, s\, x}{2\, b\, l^2} \quad \text{or}$$

$$y\, a\, S + C\, x^2 = \frac{b^2\, h^2\, s}{2\, l^2}\left(\tfrac{1}{3}\, h - \frac{h\, x}{b}\right)$$

shows that the embankment will sustain itself without any aid from the wall, wherever we have

$$\tfrac{1}{3}\, h - \frac{h\, x}{b} = o; \text{ or } x = \tfrac{1}{3}\, b = \tfrac{1}{3}\, h \tan. a;$$

for this thickness reduces the moment of the thrust to zero, whatever be the density of the embankment. For example, the natural slope being 45°, the thickness can never exceed one-third the height, though the wall be as light as a feather, and C, the cohesion of masonry, zero.

This error arises from taking A I, and not A K as the lever arm of pressure. The point of application of the thrust is at F, (B F = $\frac{1}{3}$ B C = $\frac{1}{3}\, h$), as virtually admitted by the author; its direction is F K horizontal; and its moment, in relation to any point, is, according to

the principles of mechanics, the force multiplied by the perpendicular distance of the point from its line of direction. Were F I the direction of any force, its lever arm would be a perpendicular from A to the line F I prolonged if necessary.

On this subject, the author remarks:—"We may further observe, that the method of resolving the force of the bank at the point I, instead of the point F, which former is obviously the effective point as regards the lever by which the wall turns, shows, that while the continuation of the slope falls within the base of the wall, the soil which forms it will add to the stability of the revetment; which is conformable to the experiments of Col. Pasley."—[See vol. iii of that author's "Course of Military Instruction."]

We have not access to the work of Col. Pasley, but will suggest another explanation of the fact alluded to.

The force of friction and adhesion upon the back of the wall, is always a force of some, and it may be, of great magnitude. Acting in a vertical line down the wall, its lever arm is the whole thickness of the base, and its moment, tending to prevent rotation, increases in the direct ratio of that thickness. Moreover, if this force be as great, in proportion to the normal pressure or thrust, as the friction of the earth moving upon itself, it will, when combined with the thrust, give a resultant parallel to the natural slope; and this resultant, whatever be its direction, may be taken, both in magnitude and direction, as the effective action of the embankment upon the wall; and if it fall within the base, the embankment will, of course, strengthen the revetment. But when this force is itself zero, as supposed in Mr. Barlow's analysis, the resultant just mentioned is the thrust itself—a horizontal force, which cannot fall within the base, or have its elevation affected by the thickness of the wall.

In practical formulas for revetment walls, it has not been customary to suppose any adhesion or friction upon the back of the wall; for although these forces may act during a set of experiments, and for a limited time in practice, it is not certain that they would always act, but, on the contrary, they might fail at the very time when most needed. Revetments intended to endure for ages must be regarded as exposed to earthquakes and other powerful disturbing causes. During long continued dry weather, cracks may be formed running down the wall and in other places, which, being suddenly filled with rain water, may not only destroy most of the adhesion, but give to the embankment something of the character of a fluid. If one of these cracks extending from the foot of the wall in any direction to the surface, were suddenly filled with water, so as to allow a prism of earth to descend unresisted by friction, that prism, though it might not weigh five pounds, would exert upon the wall all the pressure due to a fluid of the same height and density. It is not pretended that such cracks can ever be perfectly formed, or the friction entirely destroyed, but something like this may evidently take place.

Mr. Barlow states the importance of experiments on a large scale to determine the absolute thrusts of different earths, the cohesion of common masonry, &c.

Something valuable has been furnished and may still be furnished by the falling down of old walls: for when they fall after standing many years, we have, generally, a right to suppose they were almost strong enough, and from their profiles we can easily calculate the force which overturned them, and which they should have been able to withstand.

Ten well-reported cases of this kind would be worth more, probably, than any set of experiments, however elaborate or skilfully conducted.

Such reports should make known, fully:

(1.) The nature of the embankment, the weight of a cubic foot, and the natural slope of earth, as well as can be ascertained.

(2.) The character of the wall, the weight of a cubic foot, and the pulling force necessary to separate a square foot of surface—the force acting at right angles to the joint of separation.

(3.) The nature of the foundation, whether mud, sand, clay, gravel, &c., and whether compressible or incompressible.

(4.) The exact profile of the wall, embankment, and artificial foundations, as first constructed; and, if the rotation was gradual, the change in the direction of the faces prior to the fall.

(5.) The extent of the wall overthrown: and all other particulars calculated to throw light upon the case.

The formula for the thickness of vertical revetments, if the principles advanced in this paper are correct, should stand thus:

$$x = h \text{ tang. } \tfrac{1}{2}a \sqrt{\frac{k\,s\,h}{3(\mathrm{S}\,h' + 2\,\mathrm{C})}}, \text{ or}$$

$$x = \frac{b\,h}{l+h} \sqrt{\frac{k\,s\,h}{3(\mathrm{S}\,h' + 2\,\mathrm{C})}};$$

in which k is the coefficient of stability, and C about one-tenth the pulling force necessary to separate a square unit of surface—otherwise more accurately determined by the means described in Mr. Barlow's work.

Making $h = 12$ feet; $h' = 12$ feet; $a = 45°$; $\mathrm{S} = 156$ lbs.; $s = 125$ lbs.; and $\mathrm{C} = 500$ lbs.; that author obtains, $x = 2'.435$; which our formula also gives when we suppose $k = 1.38$.

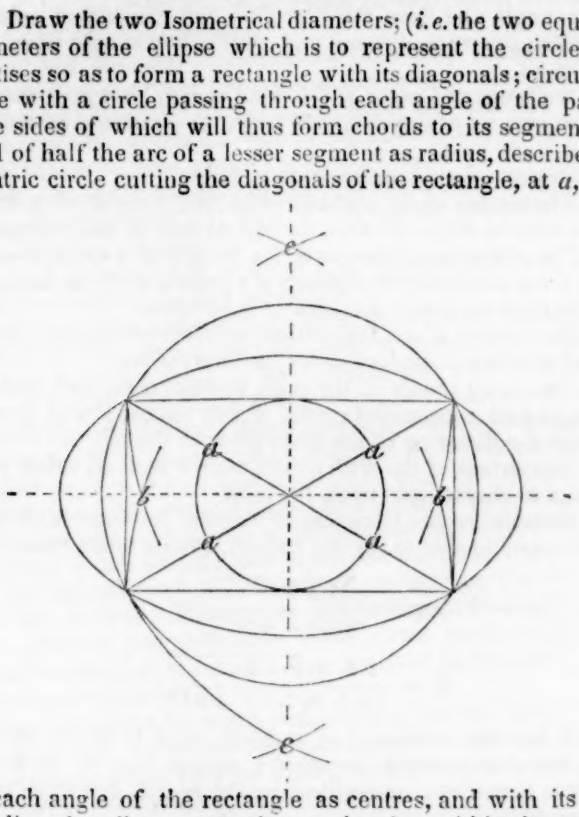
For $k = 2$, a common value, we have $x = 2'.933$.

It is, doubtless, proper in many cases to take the cohesion of masonry into view. It would not, however, be proper to graduate, in view of any such aid, walls of fortifications liable to be battered by cannon; or walls of any structure exposed to unequal settling and consequent cracks.

In conclusion, it is necessary to remark, in justice to Mr. Barlow, that he himself has pronounced the investigation in question "a very imperfect sketch," and that it has evidently received much less of his attention than many other matters treated of in his book.

A new Method to Project Circles Isometrically. *By* THOMAS PROSSER, C. E., *New York.*

Fig. 1. Draw the two Isometrical diameters; (*i. e.* the two equi-conjugate diameters of the ellipse which is to represent the circle,) unite their vertises so as to form a rectangle with its diagonals; circumscribe the whole with a circle passing through each angle of the parellelogram, the sides of which will thus form chords to its segments; with the chord of half the arc of a lesser segment as radius, describe another concentric circle cutting the diagonals of the rectangle, at *a*, *a*, *a*, *a*.



From each angle of the rectangle as centres, and with its largest side as radius, describe arcs cutting each other within the rectangle as at *b*, *b*. From the same centres, and with the diagonal of the rectangle as radius, describe arcs on the opposite side of the figure, as at *c*, *c*.

From each of the points *a*, *a*, *a*, *a*, as centres, describe arcs passing through the vertises of the isometrical diameters which are on the same side of the conjugate axis, but on the opposite side of the transverse one. From the points *b*, *b*, and *c c*, as centres, describe arcs in continuation.

Note.—*b*, *b* are on the transverse axis of the ellipse, and *c*, *c*, on a line in continuation of the conjugate axis on either side of it.

On the Comparative Advantages of Atmospheric Railways.

The paper by Mr. P. W. Barlow, on the Comparative Advantages of the Atmospheric system of Propulsion on Railways, was the result

of an examination of the system, with a view to determine as to the propriety of adopting it on the Tunbridge Wells Branch of the South Eastern Railway. The author first examined the comparative advantages of the atmospheric system over that of traction by a rope; and then he stated the reasons for supposing it to be inferior to the locomotive system. He premised that on lines similar to the Greenwich and Blackwall, where the traffic was nearly uniform, and at short intervals, the power used admitted of mathematical computation; but that on railways generally, the power required must be irregular, both as the amount required and the duration of its employment, and that therefore a power which was restricted to carrying between certain given points only, and certain intervals, would lead to great inconvenience in practice. It would be inconvenient also to have a power which could not be employed for the ordinary repairs of the road, ballasting, removing slips, conveying building materials, working the coal and lime traffic at sidings, moving goods, trucks, carriages, &c. at the stations, all which was done at present by the locomotives with a great saving of time, and of the expense of men and horses. If locomotives were employed for these purposes only, it must be at a great expense; as the keeping up a small locomotive establishment was very costly, and moreover the gradients and curves of the line must be adapted for working locomotives, and thus do away with one of the great arguments in favor of the atmospheric system. It was contended that the subsidence of embankments which at present constantly occurs without interrupting the usual traffic or being perceived by the passengers, would suffice to rupture the air-pipe or strain it in such a manner that the valve would not close, and thus cause a stoppage of the line. Many other and similar practical objections were stated against the system; but the main point was in the comparative cost of haulage, when examined with stationary and with the locomotive engines. With the former it was contended, that on lines with unfrequent trains, the small portion of time the power was actually employed, and the number of hours for which the steam must be kept up in order to be always ready, would be so disproportionate as to make the stationary engine system far more expensive than locomotive power. The lines with steep gradients were of course excluded from this position. It was considered also that with the atmospheric system, steep gradients increased the expense of power in the same ratio, as the power must always be exerted in whatever way it was applied. Several experiments were then given to show the great expense of fuel per ton of goods on the atmospheric railway, the results were decidedly in favor of the locomotive. The cost of construction was then examined, and it appeared, that referring to the calculation of the cost of working the London and Birmingham line, to lay down the atmospheric apparatus of a double line with a pipe of the required area, would not be less than 10,000*l.* per mile, or a total cost of 1,120,000*l.*, the interest of which sum at 5 per cent. would be 56,000*l.*, or 500*l.* per mile, which sum nearly equalled the average cost of working the line by locomotives, and was greater than on many lines. In fact, that a contract might be entered into for

working a line by locomotive power, for the interest of the sum which would be expended in the establishment of an atmospheric apparatus. —The general results deduced were in accordance with these observations, and it was assumed that the atmospheric system could be most advantageously adopted on short lines, with frequent traffic near large towns, where the absence of noise was important; and that railways on steep inclines in one direction, as at Dalkey, was most favorable to the system. In the discussion which ensued, it was contended that many of the objections urged by Mr. Barlow were not well founded, and that many of the practical difficulties he had advanced, had been overcome by the mechanical arrangements now in progress of execution on the more extensive lines, which were destined to be worked on the atmospheric system. That both sidings and level crossings were practicable; by a very simple contrivance, a self-acting platform could be so arranged as not only to guarantee the pipe from any injury by the traversing of a cart across the line, but that by the action of the vacuum in the main, a barrier could be raised on the passing of a train which would effectually prevent the traversing of any vehicle, and thus avoid the possibility of accidents.— That instead of the assumed liability to be thrown off the rails, it was shown that the leading carriage being tied down to the piston, greater security was attained, and that on one occasion the leading carriage on the Dalkey line had started before its time, and had actually traversed the distance at a speed of nearly 70 miles per hour, going round curves 130 to 180 yards radius. That the power stated to have been expended in the conveyance of a given gross load, was assumed at too high a ratio, and the fuel also; and that as to the question of cost by haulage by the adoption of small steam power worked only for pumping water, to be used only at the time of forming the vacuum for unfrequent or for light trains, a system of propulsion might be established, which would be more economical than that by locomotives under the best management. Trans. Soc. Arts.—Athenæum.

Vulcanized India Rubber.

At a meeting of the Institution of Civil Engineers, February 4, 1845, Mr. Brockedon exhibited some specimens of his "Vulcanized" India Rubber for diminishing the vibration of railways, by a layer of the material being introduced instead of the patent felt, between the base of the chair and the surface of the sleeper. The preparation was a mixture of caoutchouc and sulphur. Its elasticity was of a surprising character, and was stated to be preserved under intense pressure for a long period. It had been tried on the Great Western with success.

London Athenæum.

AMERICAN PATENTS.

List of American Patents which issued in the month of November, 1844, *with Remarks and Exemplifications.* By CHARLES M. KELLER, late Examiner of Patents in the U. S. Patent Office.

1. For an improvement in the apparatus for the *Treatment of Fractures of Limbs;* Livingston Roe, White plains, Westchester county, New York, November 6.

The improvement in question is applied to the well known frame which is provided with joints and extension bars and screws to adapt it to limbs of various sizes, and to extend and retain the limb in any desired position, and consists of "three troughs or movable splints made of wood and so shaped as to correspond with the half of the leg and heel. The three differ in size only, and may be adapted to legs of all sizes. On the lower or convex side of these troughs or splints, and at about equal distance from the extremities thereof, is fastened a plate of metal with flanches on each side of it, and at such distance from each other as to fit the bar when the splints are placed upon it. And the design of them is to secure the said movable splints when sliding on the bar to which it is secured by a key. The object of the movable splint is to enable the surgeon, by removing one and substituting another, to employ which of them he pleases, according to the size of the leg, &c.; and also to enable the surgeon to adapt and treat with one trough only a greater variety of sizes than can be done with any known apparatus. There are other splints adapted to the outer and inner surfaces of the leg and ancle—these are also of different sizes, and have on the outside leather studs, through which the straps for binding them to the leg, &c. are passed. Another splint is adapted to the under side of the thigh, and made movable and secured to the thigh piece of the frame by means of a screw. And three other splints lined with leather are adapted to the sides and top of the thigh, and secured by straps, &c.

Claim.—"I do not claim the mode described of flexing and extending the framework; nor do I claim the mode of extending or shortening the splints as described. But what I do claim, is the combination of the splints (whether adjustable or not) with the hinged bar or framework; said bar being extended and flexed in substantially the manner described, and said splints being independent of the bar, and so constructed as to be readily attached or detached at pleasure, for the purpose herein described; the whole construction being substantially as herein set forth. I have applied the same principles of construction to the upper extremities, the modifications being only in form to suit the shape and motions of the upper limbs."

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2. For an improvement in the *Straw Cutter;* E. Taylor, Rochester, Monroe county, New York, November 6.

The movable knife of this straw cutter is operated by having one

end jointed to a crank pin on the fly wheel, and the other to one end of a vibrating lever, by which a draw cut is given. At the junction of the knife and lever a connecting rod is jointed which extends down and is jointed to one end of a lever, turning on a fulcrum near the middle of its length, the other end being provided with a whetstone, which, as the knife descends, rises and rubs against the outer face of the knife, and sharpens it.

Claim.—"Having thus fully described the nature of my invention, what I claim therein as new, and desire to secure by letters patent, is the adjustable whetstone so arranged and combined as that it shall meet in its ascending angular motion the edge of the knife in its descending angular motion, thereby setting the edge in towards the straw-rest, and giving the edge of the knife an appearance much like that of the sickle."

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3. For an improvement in the *Truss for the Treatment and cure of Hernia;* Eliakim C. Darling, New Orleans, Louisiana, November 6.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the use of a continuous metallic band entirely encircling the body and fastening in itself, and of such materials as not to stretch by use, but of such malleability as to allow any person to shape it to themselves at pleasure; thereby doing away with the use of leather or other straps of stretching material."

The pad and its appendages are connected with this metallic belt in the same manner as heretofore with the spring.

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4. For a *Balance Crane for Raising and Weighing Heavy Bodies;* Louis Henry, Paris, France, assigned to Claudius Gignoux, New York city, New York, November 9.

"The nature of my invention," says the patentee, "consists in combining with a lifting crane, a weighing apparatus, so that the articles that are raised by the crane, can be at once weighed, thereby facilitating the double operation."

The mast of the crane instead of being supported at the top and bottom in permanent bearings, is connected with a standard, supported in the same manner as the mast of the ordinary crane, by means of links, and connected with a steelyard balance, so that the whole weight of the crane can be made to rest on the balance, and knife edges in links at the top of the mast.

Claim.—"Having thus fully described my improvements, and the operation of the same, what I claim therein as new, and desire to secure by letters patent, is the combination of the balance or steelyard with the lifting crane, substantially in the manner and for the purpose herein set forth."

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5. For an improvement in the *Grain Cradle;* Wm. A. Wood and John C. Loveland, Hoosick Falls, Renssellaer county, New York, November 9.

This is for making the teeth of metal tubes or partly of metal teeth and partly wood, instead of wood alone, and when made partly of wood and partly of metal, the hollow metallic part constitutes the extremity which is the most liable to bend.

Claim.—"What we claim as our invention and improvement, and desire to secure by letters patent, is the use of said hollow metallic teeth and hollow metallic parts of teeth; the metal being less liable than wood to relax and straighten."

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6. For improvements in the *Cotton Press;* Jedediah Prescott, Memphis, Shelly county, Tennessee, November 9.

The follower of this press is operated by means of two parallel levers jointed to the underside of it (one at each end) and to a carriage, that runs on truck rollers on the bed of the machine, and is worked by cords passing around pulleys and extending to a capstan. The ends of the box are let into grooves in the follower or platen of the press, and work up and down with it, and at the end of the operation they are lifted out of these grooves and liberated by two short levers that strike against projections on the frame—these levers are designated in the claim by the letter *z*. The lower edges of the sides of the box are jointed to the frame, and, when closed, are held in place by two bars, which are thrown up towards the end of the operation, by pins connected and moving with the platen.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is—1st. The combination of the inclined parallel levers with the horizontal carriage and rollers, arranged and operated in the manner and for the purpose set forth. 2d. The arrangement of the ends *d* of the box grooves in the platen, so as to rise and fall with the platen, and be liberated from it at the termination of the pressing.—3d. The combination of the levers *z* with the platen, arranged and operated in the manner and for the purpose above set forth. 4th. The manner of disengaging the bars from the box, by means of the pins upon the ascending ends of the box, in order to throw open the sides of the box, to tie and remove the bale."

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7. For improvements in the *Tide Mill;* John Gerard Ross, New York city, New York, November 9.

The wheel is placed in a race, at one end of which there is a tide gate hinged to a wall beyond the end of the race and shutting against either side of the race; and at the other end of the race there are two current gates, one termed the "inner current gate," and the other the "outer current gate," these are hinged to the ends of the race way wall and shut against a pier placed beyond the end, and in a line with the middle of the width of the race way. The current in passing along opens the "current gate" and after acting on the wheel passes out through the "outer current gate," and on the return tide the pressure of water closes this "outer current gate," which causes the current to pass around to that side of the tide gate opposite to that at which it entered on the rise of the tide, throws it against the opposite

side of the race-way, acts on the same side of the wheel as on the rise of the tide and passes out through the "inner current gate." The dam walls are formed with pits open at the sides for the free ingress and egress of the water to act on floating caissons which sustain the wheel and always keep it at the required elevation. The shaft of the wheel (or wheels) is connected with the frame work of the mill by bars radiating from the axis of a cog wheel, into which mash the cogs of the master wheel.

Claim.—"First. I claim as new, and of my invention, and desire to secure by letters patent, the mode described of fitting the tide-gate I, at one end of a race-way, formed by an inner and outer dam-wall, in combination with an outer current-gate K, and an inner current-gate L, at the opposite end of the race-way; the whole constructed and operating substantially as herein described.

Second. I claim the mode of forming the dam-walls with pits, open at the bottom, to receive and float the caissons that carry the water-wheel; and the combination therewith of the described means for regulating, adjusting, and directing the ascent and descent of the wheel or wheels, substantially as the same are described and shown herein.

Third. I claim the combination of the described mode of fitting the gates and wheel, and making them act together in the manner described herein."

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8. For an improvement in the *Smut Machine for Cleaning Grain;* Jacob Groat, Troy, Rensellaer county, New York, November 9.

This is for the addition of a reservoir or spout to the case, or concave, which surrounds the beater and rubber, into which the grain is thrown, and the discharge therefrom is regulated by a gate, so that the grain may be kept in the machine as long as may be necessary to clean it thoroughly.

Claim.—"Having thus fully described my improvement, what I claim therein as my invention, is, first, the regulating reservoir or spout, constructed as above described, in combination with the cylinder and concave, as herein specified."

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9. For an improvement in the *Means of Removing Mud, Sand Bars, &c., from the Beds of Rivers, &c.;* Dennis Vermillion, Washington, D. C., November 9.

A mass of logs are put together in the form of a boat, to be moved down by the current, tide, or otherwise, and which from its great weight and strength will acquire great momentum. Iron breakers, sharpened at the lower end, pass obliquely through apertures in this mass, and extend down to the depth required to act on the obstruction to be removed. At the stern there is suspended a drag rake, connected with the boat by means of two arms that slide freely in apertures in the ends of a cylinder which is hung on appropriate journals; and for the purpose of raising this rake, cords extend from it to a windlass on the boat. The operation of the apparatus is this—The boat being put in motion by the current, or otherwise, is directed towards

the sand bank, or other obstruction, and the breakers and rake having been set to the required depth, the breakers cut up and loosen the sand, mud, &c., which is then raked into deeper water.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of a bulk of square logs, resembling the hull of a vessel, the adjustable breakers and the rake with its oscillating cylinder and windlass; the whole forming an apparatus for removing sand or mud bars or shoals, or other similar obstructions to navigation, from the beds of rivers and other waters; said apparatus being (substantially) constructed, and operated, as herein above described."

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10. For an improvement in the *Cultivator Tooth;* James Birdsell, Hamilton, Chester county, Pennsylvania, November 9.

The nature of this invention consists in attaching a separate cutter to the tooth of a common cultivator constructed in the ordinary way; the said cutter being so formed as to be turned to make the heel become the point, and vice versa. It is convex on the upper, and concave on the under side, and the latter rests on the ground, so that being reversible it will keep sharp until worn out.

Claim.—"Having thus fully described my improvement, I wish it to be understood that I do not claim a self-sharpening cultivator tooth, as that is known; but what I do claim as my invention, and desire to secure by letters patent, is the self-sharpening convex cutter constructed substantially as herein set forth, in combination with the cultivator tooth, in the manner and for the purpose described."

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11. For an instrument for *Measuring Coats, Vests, &c, and for Drafting the same for Cutting;* John P. Combs, Trenton, Mercer county, New Jersey, November 9.

Two scales are jointed together and provided with a protractor, and to each of these scales there is a measuring tape attached by eyelet holes and buttons at given distances apart on the face of the scales and corresponding with the marked divisions thereon.

Claim.—"What I claim as my invention, and desire to secure by letters patent, are the jointed protractor, and the straps or measures, and attached with the screw and eyelet holes, as before described; by means of which all the angles necessary to be had, in order to insure a perfect fit, are easily and accurately obtained."

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12. For an improvement in the mode of *Constructing Fire Places and Flues;* Daniel Hemingway, Leesburg, Harrison county, Kentucky, November 13.

The back of the fire place is vertical to a certain height, it then falls back about one foot inclining upwards to the height of the arch, and from this line it widens out on each side in a circular form, and contracts in the same manner to form the flue.

Claim.—"I do not claim expanding the flue above the throat; but what I do claim as my invention, and which I desire to secure by letters patent, is dropping the back of the fire place below the arch,

in the manner described, in combination with the expanding flue, substantially in the manner set forth."

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13. For an improvement in the *Horizontal Wind Mill;* Daniel Dennett, Centreville, St. Mary's Parish, Louisiana, November 13.

The wings or vanes of this mill are jointed to radial arms, and are suspended by cords to vibrating levers that pass through, and are jointed to, the shaft above the arms to which the wings or vanes are jointed, so that by this arrangement the moment one vane begins to make "back wind," (as it is termed,) it is blown down, and by its connection with the one on the opposite side of the shaft draws it up to catch the wind.

Claim.—"Having thus fully described the nature of my improvements in the horizontal wind-wheel, what I claim therein as new, and desire to secure by letters patent, is the manner herein set forth, of combining the motion of the two opposite vanes by means of cords, chains, or rods, by which they are connected to the end of a vibrating beam, substantially in the manner and for the purpose herein made known."

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14. For a machine for making *Tuscan or Leghorn Braid;* Elisha Fitzgerald, New York city, New York, November 13.

It is to be regretted that, from the necessary complexity of the mechanical arrangements, a description without drawings could not be made sufficiently clear. After the pieces of straw have been deposited in a box, the whole operation of taking each separate piece, introducing, bending it over, trimming off the surplus, and transferring and retransferring the pincers or nippers by which the pieces are held, and the completed braid delivered, is carried on, with the most beautiful regularity, without the hand of an attendant.

As the claim refers to, and is wholly dependent on the drawings, we are under the necessity of omitting it.

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15. For an improvement in the manufacture of *Lamp Black;* Gilbert Mini, Philadelphia, Pennsylvania, November 13.

The rosin or other material to be burned is put into a furnace which opens into a large room, without chimney or any other opening than the one communicating with the furnace.

Claim.—"What I claim as my invention and improvement, and desire to secure by letters patent, is the mode herein described of burning lampblack—that is to say, burning it in a confined building or room without a chimney or draught, substantially in the manner set forth in the above specification."

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16. For an improvement in the *Point for Manifold Writers;* Jesse K. Park, New York city, New York, November 13.

The "nature of this improvement consists in making a spiral flexible point, of either steel, platinum, gold or silver wire, or any other metal suitable for the purpose. Said spiral to form a cone and so

attached to the handle as to have a point within it to check the elasticity and prevent the point from yielding too much.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the manner in which I construct my point for manifold writing, by combining with the conical spiral wire point, the check point, in the manner described, and attaching them to a handle for the purpose described."

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17. For an improvement in the method of *Preventing Chimneys from Smoking;* Joseph Gilbert, Frease's P. O., Stark county, Ohio, November 13.

Channels are made around the fire place, before the pilasters and fascia are put on, which communicate, by means of vertical channels in the stack, with the spaces between the floors and ceilings to conduct cold air to the fire place. The pilasters and fascia of the mantel are placed over these channels, thus forming the front thereof. The lower portion of the fascia of the mantel is brought to a feather edge, so as to form a horizontal longitudinal space behind the mantel communicating with the horizontal air channel in the breast of the chimney, through which space behind the mantel, the cold air passes from the said channels to the fire place.

Claim.—"I do not claim admitting the external air for the purpose of preventing chimneys from smoking, as that has been done before; but what I do claim, is the mode herein described of introducing the air—that is to say, between the mantel and the arch, in the manner and for the purpose described."

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18. For an improvement in *Manufacturing Lard and Tallow;* H. A. Amelung, St. Louis, Missouri, November 13.

This process consists in extracting fat from fibrin, &c., by mechanical means, such as rollers, and discharging into a vat divided into an upper and lower compartment by a sieve, which permits the oil and fat to pass into the lower compartment, from which it is put into a warm water bath, to separate the oil and fat entirely from the fibrin, albumen, &c. And, in conclusion, the fat is put into a vessel heated by steam, to be cooked.

Claim.—"What I claim therein as new, and desire to secure by letters patent, is the process herein described of obtaining fat from the fibrin, &c. before it is cooked, and afterwards cooking the expressed fat in the manner described; by which the danger of injury to the lard, by cooking it with its impurities, is obviated, and a much purer article obtained, as well as a saving effected."

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19. For an improvement in the machine for *Sowing Grain Broad cast;* Ezra Fisk, Fayette, Kennebec county, Me., November 18.

There is a cylinder placed at, and which closes up, the opening in the bottom of a hopper. This cylinder is grooved longitudinally, and in rotating, the grooves carry out the seeds, which would be thrown on the ground in rows, were it not that the frame, or "platform,"

which holds the hopper and cylinder, has a reciprocate movement communicated to it by spurs on the axle of the supporting wheels of the machine, and a spring, which casts the seeds broadcast over the surface of the ground. Along the lower edge of the hopper there is a brush for clearing the surface of the cylinder of the surplus seeds.

Claim.—"What I claim, is the combination of the vibrating grooved cylinder with the vibrating slide or platform, and also, in combination with the vibrating cylinder, the brush as described; said parts being arranged and operated substantially in the manner set forth."

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20. For an improvement in the *Wheat Fan or Winnowing Mill;* William Stanley, Jamestown, Guilford county, N. C., November 18.

Claim.—"I do not claim a spiral fan wheel, as that has been before used with winnowing machines; but what I do claim, is placing upon the same shaft two spiral wheels, so arranged and combined that the air shall be drawn in at both ends of the concave cylinder which surrounds them, and contracted and forced out at the centre upon the screens, or be used for any other purpose where a strong blast of air is required, substantially in the manner herein described."

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21. For an improvement in the *Cooking Stove;* James H. Lyon, Schenectady, New York, November 18.

The furnace of this stove is placed above the oven, and slides thereon, from front to back, by means of handles passing through the front of the stove, to regulate the baking in the oven.

Claim.—"I claim as my invention, the government of the heat of an oven during the process of baking, by combining therewith a movable furnace, situated immediately above said oven."

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22. For improvements in the *Mowing or Reaping Machine;* Wm. F. Ketchum, Buffalo, Erie county, New York, November 18.

In this machine, the grain is cut by means of vibrating cutters, projecting somewhat in the manner of saw teeth from one edge of a plate. The cog gearing which forms the connexion between this vibrating plate and the supporting wheels of the carriage, to which the whole mechanism is attached, is placed within the supporting wheels that have cogs on their inner peripheries, and are cased in to protect the mechanism.

For the purpose of bending in the heads of grain and holding them whilst being cut, there is an endless apron which passes over rollers at a proper height above the cutters.

Claim.—"What I claim as my invention, is the combination of the driving wheels with the cutters, in the manner described, by forming internal gear on the wheels, and inclosing all the driving gear inside of them by the construction and arrangement above set forth.

"I also claim the employment of an apron in combination with the cutters, for turning in the tops of the grain, as herein described."

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23. For an improvement in the *Machine for Separating Grain*

from Straw; Manning and Christopher Packard, Clarendon, Orleans county, N. Y., Nov. 18.

A belt, or apron, is made to pass over rollers, at the upper and lower ends of an inclined board, and above this there is arranged a succession of rotating beaters, the shafts of which are placed at equal distances apart from end to end of the inclined plane. These beaters are composed of bars parallel with the shaft, and arranged in an ellipsis around it, and the greater diameter of the first is placed at right angles to that of the second, the third corresponds with the first, the fourth with the second, and so on, throughout the series. The grain and straw from the thrashing machine is discharged at the top of these beaters at the bottom of the plane, and by their rotation, the straw is carried up and discharged at the top, and the grain thus separated falls into the apron, and is by it carried to a fan.

Claim.—"What we claim as our invention, and which we desire to secure by letters patent, is the combination and arrangement of the revolving oval racks for conveying the straw and separating the grain therefrom, operated in the manner set forth, or other mode substantially the same. We also claim the combination of the revolving endless apron, with the before described revolving oval racks, arranged in the manner and for the purpose set forth."

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34. For improvements in the *Rotary Steam Engine;* Matthew Fletcher, England, Nov. 18.

The pistons of this rotary engine are attached to, and rotate with a drum placed within a permanent cylinder and eccentric thereto, the periphery of the drum being in contact with one part of the inner periphery of the cylinder. The outer face of the pistons are segments of circles equal in diameter to the inner periphery of the cylinder, and their inner edges are jointed to slides that play in radial grooves in the drum. As it is indispensable that the outer faces of the pistons, in their rotation, be kept concentric with, and therefore, their inner edge converging to the centre of the cylinder, their ends are connected with segments that rotate in an annular, formed by two rings or circles, concentric with the cylinder. And to prevent, in some measure, the friction produced by the centrifugal force which presses the pistons against the periphery of the wheel, a ring, or hoop is let into a groove in the face of the segments on the ends of the pistons, which binds them together and prevents the centrifugal action.

Claim.—"What I claim, is—1st, the concentric and eccentric motion, in conjunction with the jointed fliers or pistons, which causes the said fliers or pistons always to point to the centre of the cylinder, and keep the same radius as the cylinder. The eccentric motion, alone, would not carry out the fliers or pistons to form a true circle, if not in conjunction with the principle of jointed fliers.

"2d. I claim the method of taking the friction from the outside of the fliers or pistons, against the sides of the cylinder, occasioned by the centrifugal force, by means of the 'ring or hoop' which unites the fliers or pistons in manner substantially as described."

35. For an improvement in the *Smelting Furnace;* Leman Bradley, Sharon, Litchfield county, Connecticut, November 18.

This consists in dividing the stack into two, three, or more compartments, by means of partitions, extending from the top to a point a little above the entrance of the blast. Into one of these divisions the coal only is put, and the usual charge of ore, coal, &c., in the others; and that part of the hearth which is below the coal division is elevated above the other portion, that the coal may be kept up to the blast, and permit the melted metal to descend below it. The patentee sums up the operations and the advantages in the following words, viz: "The greatest part of the charge being put in the compartment next to the headstone, the metal will rest on the boshes, and will not come down faster than it is melted by the blast—the principal part of which comes in through the body of coal in the chamber, from the blow-pipe; the combustion being thereby rendered perfect before the blast reaches the metal, a great saving of fuel is effected, and a better quality of iron is produced. The damper over the coal chamber is kept down during the operation, and the gases are allowed to escape through the chambers on the opposite side of the partition. The fuel in the chamber rests on the hearth, and cannot fall much below the blast. A small blast can also be thrown in on the opposite side of the furnace to the main blast, which is regulated at pleasure."

Claim.—"Having thus fully described my improvements, what I claim therein as my invention, and desire to secure by letters patent, is dividing the interior of the furnace stack into two or more compartments, by partitions, which descend nearly to the bosh of the furnace—the bosh being the same as that of the common blast furnace, except the elevated hearth; the whole being constructed, arranged, and combined, in the manner and for the purpose herein set forth.

"I also claim the hearth, raised above the common hearth, and with the bosh, so that the melted metal will fall below the blast, and the fuel be retained up to the blast, as set forth."

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36. For an improvement in the *Press for Packing or Compressing Cotton;* Peter M. Wright, New York City, N. Y., November 26.

The follower of this press is carried down by means of connecting rods, jointed to the follower and to cogged segments, operated by pinions; and for the purpose of increasing the capacity of the press for larger bales, the rods are connected with the follower by means of notches (called by the patentee ratchets) in the rods, which fit into pins or wrists projecting from the sides of the follower.

Claim.—"I claim the method of increasing the capacity of the press, by prolonging the upper ends of the connecting rods or levers, in connexion with the ratchet as described."

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37. For an improved method of making *Stereotype Plates;* Clement Davidson, Saratoga, New York, November 26.

Claim.—"Having thus described my improvements and their operation, what I claim as my invention, and desire to secure by letters

patent, is—1st. The joining the moulds in the manner described, or in any other substantially the same.

"2d. I claim constructing the casting pan in the manner described, with upright tubes at the sides thereof, through which the metal flows into the pan; and the cover having a cup formed on the top thereof, with holes through it into the pan: the whole being arranged in the manner and for the purpose described.

"3d. I claim the combination of the moulds, the floaters, or plates between them and the pans, in the process of stereotyping, substantially in the manner and for the purpose set forth; by which any convenient number of plates can be cast at one time, without danger of breaking the moulds, or injuring the face of the letters, by *dirt*, or *dross*, or *shrinkage*.

"4th. I claim the combination of the revolving and stationary cutters, for reducing and leveling the back of stereotype plates, as herein made known; and, in combination therewith, the springs or fingers for holding down the plates.

"5th. I claim the combinations of the chisels, constructed and arranged as herein described, with the ordinary leveling machine, in the manner and for the purpose above specified.

"6th. I claim, also, the revolving marginal cutters, for leveling the edges of stereotype plates, arranged and constructed in the manner set forth, in combination with the chiseling machine for finishing stereotype plates."

Without drawings, or a description beyond the limits of this work, the nature of these improvements could not be indicated better than by the above claims.

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38. For improvements in the *Machine for Cutting Shingles;* Tillott Cole, Kent, Putnam county, New York, November 26.

In this machine, the knife for cutting the shingles is attached to a sliding gate, and the block of wood is put upon a platform, and, after the cut of a shingle, pushed up by the attendant, for another cut; and the block is gauged by means of two vertical eccentric rollers attached to, and moving with the knife gate. The eccentricity of these rollers is for the purpose of so gauging the block as to cut the butt alternately, from opposite ends of the block, by giving them half a revolution to each stroke of the knife, which is effected by an arrangement of levers jointed to the gate and pitman, that, by means of a hand taking into a ratchet wheel, turn a cog wheel connected with a pinion on each of the rollers.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is—1st. The combination of the eccentric rollers, for gauging the thickness of the shingle to be cut, with the knife gate, as herein described. 2d. In combination with the eccentric rollers on the vibrating gate, the arrangement of cog-wheels, ratchet, and levers, for rotating the eccentric rollers as described."

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39. For an improvement in the *Hand or Bench Plane;* Levi Sandford, East Solon, Courtland county, New York, November 26.

A plate of iron is attached to the back side of the "throat," or rather the bed on which the bit lies, which receives the screw that secures the cap to the bit, to make a double iron, so that the same screw binds the two irons together and to the stock, the two irons being provided with elongated holes for the screw to pass through to admit of adjustment. And this same plate or block of iron attached to the stock, receives the end of a screw which extends up beyond the upper end of the bit, where the two are connected by a collar, so that by turning the screw, the bit can be set to any degree of cut required.

Claim.—"I am aware that a patent has been granted for a plane, in which there is a piece of metal secured to the back part of the throat of the plane, to receive a screw, by which the bite of the bit is regulated. And I am also aware that a screw has been used for drawing cutting tools in and out, at pleasure, to regulate the degree of bite; and therefore I do not claim these devices as my invention. But what I do claim as my invention, and which I desire to secure by letters patent, is the arrangement by which the piece of metal at the back side of the throat receives the screw that secures the cap embracing the bit; and, also, the set screw for the adjustment and moving of the bit; by which arrangement, the said bit can be set without moving the cap, as described."

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40. For an improvement in the *Mortise Latch for Doors;* Wm. Wilson, Northampton, Hampshire county, Mass., November 26.

Claim.—"Having thus fully made known and described the manner in which I arrange and combine the respective parts of my cylindrical mortise latch, what I claim therein as new, and desire to secure by letters patent, is the manner of retracting the bolt by means of two slides, actuated by means of a toothed pinion—said slides receiving the horns of the bolt, and constituting two racks, formed and operating substantially as set forth."

Each of the two slides moves in opposite directions, and the horns of the bolt are back of a shoulder on the slides, so that the slide that moves backward by the turning of the pinion, which is on the spindle of the knobs, carries the bolt back, whilst the other is at liberty to move forward. By this arrangement, the turning of the knobs in either direction will move the bolt.

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41. For an improvement in the *Cheese Press;* John Martin, Jr., Medina, Medina county, Ohio, November 26.

The piston of this press slides in a frame, the bottom of which, constitutes the bed of the press. The head of the piston is provided with a set of rollers, arranged around the counter, and the top of the frame is provided with a corresponding set. One end of a cord is attached to the head of a piston and passes around the two sets of pulleys, and then through a hole in the piston head to a windlass above. After the cheese has been put under the piston of the press, the windlass is turned sufficiently to suspend the whole press, and by the arrange-

ment of the cord to which it is suspended, the weight of the press continues to make pressure on the cheese.

Claim.—"What I claim as my invention, and which I desire to secure by letters patent, is the before described combination of the block, or frame, of the self-acting press, with the piston, cord, pulleys, and windlass, suspended and operating in the manner and for the purpose set forth."

List of American Patents which issued in the month of December, 1841, *with Remarks and Exemplifications. By* CHARLES M. KELLER, *late Examiner of Patents in the U. S. Patent Office.*

1. For improvements in *Machinery for Raising Sunken Vessels;* John Custis, Yarmouth, Barnstable county, Mass., December 10.

Frames are built on two floats, and these are connected together by means of several truss frames, leaving space enough between the two floats for the reception of the vessel to be raised, and the ends of the truss frames rest on the heads of jack screws. A chain, (or chains,) passes around the body of the vessel, below what constitutes the water line of a vessel, and is then connected with the truss frames by other chains in the manner fully expressed in the following

Claim.—"I shall claim the peculiar combination of the two truss frames extending between two opposite standards, each having depending chains with links, or hooks, by which, said truss frames may be alternately connected to the vertical chains which are attached to the horizontal chain extending around the vessel, or about the bottom of the same, as above explained, by which arrangement of the apparatus the vessel may be raised by bed screws, as described.

"Also, the combining with said truss frames, the horizontal chain whose ends are passed through loops, or strong rings, attached to it where it comes in contact with each side of the bow abaft the cutwater, by which disposition of loops upon the chains, the chains can be fitted to vessels of different sizes, and be caused to bind tightly around the bottom, so as not to slip over the same; the whole being arranged, constructed, and operating substantially as above explained.

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2. For a machine for *Turning or Bending the heel of Scythes, or that part which fits into the Snath;* Abel Simonds and A. G. Page, Fitchburg, Worcester county, Massachusetts, December 10.

The heel of the scythe is griped between a rest block, attached to the top of a bed plate, and a sliding griping bar operated by a hand lever, arranged below the bed plate, and then that part of the heel which is to be bent, and which extends beyond the griping bar and rest block, is bent by a bending lever jointed to the bed plate, and operated with a toggle joint lever connected with a sliding rack, the teeth of which are thrown into gear with a pinion by the lever which operates the griping bar.

Claim.—"Having thus described our invention, we shall claim the combination of the bending lever with the griping bar, and also with

the rest block, and operating the said bending lever, by the combined arrangement of toggles or progressive levers, rack bar and pinion, the whole being arranged substantially as herein set forth."

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3. For improvements in machinery for *Raising Blocks of Ice from a Pond;* Nathaniel J. Wyeth, Cambridge, Middlesex county, Massachusetts, December 10.

In this piece of mechanism there are two gigs, or vertically sliding frames, one for hoisting the blocks of ice from the water and depositing them on to the inclined railway, down which they slide to the other gig, or sliding frame, for letting down the blocks on to a car or sled.

The hoisting gig is provided with balance bars, jointed to the frame of the gig, which correspond with the rails of the railway, and they are so jointed to the frame as to have their greatest length from the fulcrum out towards the railway, so that the weight of the block of ice will preponderate and cause the balance bars to take the inclination of the railway.

Claim.—"I shall claim the application to the hoisting gig of the *balance bars*, constructed and operating substantially as above set forth. Also the combination of the depressing gig with the receiving railway; and the combining of the said depressing gig and receiving railway with the elevating gig; the whole being constructed, arranged, and operating substantially in manner and for the purposes hereinbefore explained."

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4. For improvements in machinery for *Raising Blocks of Ice from the Water and Depositing them on a railway;* Nathaniel J. Wyeth, Cambridge, Middlesex county, Massachusetts, December 10.

In this improvement I shall claim, elevating blocks of ice from a lower to a higher level, by means of the sled, in combination with the ascending and descending inclined planes and horizontal rails extending over the descending plane, and which horizontal rails receive the blocks of ice, when the sled passes down the rear plane, the whole being constructed, arranged, and operating substantially as herein above set forth.

Also, that arrangement of machinery or addition to the sled which is herein termed the *catch*, for the purpose of retaining the blocks of ice over the sled and preventing them from sliding down the inclined plane when they are received upon the slide rails of the planes, the same being constructed substantially as herein before explained.

Also, the method of connecting the inclined and descending planes and horizontal rails with the transportation railway, at any desirable station of the latter, by arrangement of curved slide and guide rails supported on a platform having railway wheels connected to it by which it may be transported from place to place as occasion may require, the whole being constructed and arranged on principles and in manner substantially as described. Also constructing the rail way cars in the manner above set forth, with slide rails arranged on their

bottoms and guide rails on their sides, and connecting those of each car by the hinged ends, each having a small lapping rail upon it, which extends over that in contiguity with it, and by means of which any two cars may be united, whatever ends of the same are brought together, the whole being for the purpose of sliding the blocks throughout the train and leading the same thereon and unloading the same therefrom as herein before described.

Also curving the guide rails and commencing them in rear of the slide rails as described, for the purpose of causing the ice to resume its proper position on the sled to pass up the inclined plane, should the ice by any accident have been forced over the side of one of the runners more than that of the other.

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5. For improvements in *Machinery and Railway Cars for discharging Blocks of Ice from Cars and depositing them in Store Houses;* Nathaniel J. Wyeth, Cambridge, Middlesex county, Massachusetts, December 10.

Claim.—"Constructing cars for the transportation of ice, with the elevating lever bars, which discharge the blocks of ice out of the sides of the cars, the said lever bars being elevated by bent levers (or other suitable means,) as described, and combining said lever bars with the slide rails of the cars, and with the tables or platforms arranged by the sides of the cars, and upon which the ice is received when discharged from the cars, the said tables being constructed on the principles herein before mentioned. I also claim the arrangement of the slide rails,—so that they may be elevated above the surface of the table, the whole of the above parts claimed being constructed and operating substantially in the manner as I have herein before set forth."

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6. For an improvement in *Water Wheels;* John L. Smith, Salina, Onondaga county, New York, December 10.

Two of these wheels are put on a horizontal shaft, one on each side of the trunk or tunnel through which the water is applied to the wheel, the face towards the tunnel being open for that purpose. The apertures or issues for the water extend from the shaft to the outer rim, which is scolloped for that purpose, and are formed by the forward edge of one bucket, and the back edge of the other, these being placed diagonally for this purpose. And to the back edge of each of these buckets there is a flanch radial in its length, and parallel with the shaft in the direction of its width, which extends to the inner face of the wheel, or to the floor.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the mode of constructing the bucket as set forth, namely, by forming it with a flanch on the inner face of the wheel, extending from the hub, or centre, to the circular scolloped rim, and attaching its outer edge to said scolloped rim, all as before described

7. For an improvement in the *Smut Machine for Cleaning Grain;* John D. Beers, Philadelphia, Pennsylvania, December 10.

A rotating fan is placed in a horizontal cylinder open at each end near the shaft, for the admission of air, and the cylinder is provided with conveyors placed diagonally on the outer surface, and communicating with the inside by means of slots through which the grain is forced by the current of air into them, and at one end they communicate with a semicircular conduit on one of the heads, through which the dust, chaff, &c., is discharged. The grain is fed into the cylinder through an inclined trunk connected with the cylinder by means of a rule, or other joint.

Claim.—"What I claim therein as my invention, and desire to secure by letters patent, is the manner in which I have arranged and combined the cylinder, the conveyors, and the openings therefrom, into and through the conduit or tubular space on the head of the cylinder, for the purpose herein fully explained and made known. I claim also the manner of feeding the grain into the cylinder, containing the revolving vanes, or beaters; the same being introduced through an inclined trunk or pipe furnished with a rule or other analogous joint so as to give any desired elevation thereto, and so that its inclination may be graduated to the nature of the grain and the velocity of the motion of the fan; and I likewise claim the mode of regulating the winnowing of the grain in its discharge from the cylinder, according to the intensity of the blast produced by the vanes, by means of a discharge tube furnished with a graduating joint, in combination with the vanes; by means of which arrangement, the same blast is made to winnow the grain, both in the feeding and discharge tube, substantially in the manner herein made known."

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8. For an improvement in *Carriage Springs;* R. B. Brown, Essex, Chittenden county, Vermont, December 14.

At the bottom and on each side of the body of the carriage, there are two helical springs wound on a bar; they are held between permanent blocks, and the end of sliding rods connected with straps attached to each end of a grasshopper spring; and a roller attached to each end of the carriage body frame rests on these straps, so as to render available the force of the grasshopper and the helical springs.

Claim.—"What I claim is the arrangement of the helical springs, rods, straps, and rollers, in combination with the grasshopper springs, for the purpose and in the manner described."

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9. For an improvement in *Tuyeres for Forges;* Riverius C. Stiles, and Joseph S. Graves, East Bloomfield, Ontario Co., N.Y., December 14.

Two pyramidal tubes project from the top of the wind chest, the space between them being sufficient for the bed of the fire, and the apertures for the discharge of the wind being near the top of the pyramids and in a direction towards each other, so as to concentrate the blast between the two pyramids.

Claim.—"What we claim is combining with a wind chest arranged as described, two or more tubes, or two or more apertures inclined towards each other, so as to produce a concentrated blast."

10. For an improvement in the *Horizontal Double Acting Suction and Force Pump;* Joel Farnam, Stillwater, Saratoga county, New York, December 14.

Claim.—"I am aware that pumps have been made and patented with two pumps or channels placed at the side of the cylinder and extending from top to bottom, separated by a partition extending from end to end, and provided with valve seats, and cups, at top and bottom, or at bottom alone, and therefore I wish it to be understood, that I do not claim these modes of arrangement in this application.—But what I do claim as my invention, and desire to secure by letters patent, is the arrangement of the trunk, as above described, on each side of a partition placed equidistant between the two ends of the cylinder, each one communicating with that end of the cylinder nearest which it is placed, and provided with cups and valves above and below the two trunks, substantially as herein set forth."

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11. For an improvement in the *Manner of Combining a Coking Oven for Coking Bituminous Coal, with Boilers for Generating Steam;* Reuben Mc Millen, Middlebury, Summit county, Ohio, December 14.

Claim.—"I do not claim to be the first that has combined an oven for coking with a boiler or boilers for generating steam, with the intention of economizing heat, but what I do claim as new in my apparatus is the method of applying heat in the coking of bituminous coal, and of coking the same by means of an oven, or ovens, consisting of two or more compartments, divided from each other by close partitions, and to which compartments the coal is supplied, and its combustion and coking regulated as set forth, the same being combined with the boiler, or boilers, as specified, and the whole being constructed and operating substantially in the manner described."

Decision in a suit, brought by John B. Emerson, in the Circuit Court of the United States, for the infringement of his patent for a Submerged Wheel with Spiral Propellers, by Hogg & Delamar.

This was an action for an alleged infringement of a patent granted to the plaintiff for a submerged wheel, with spiral paddles, intended to propel vessels. The defendants conduct the Phœnix Foundry, in the city of New York, and had fitted various vessels with "Ericsson's propellers." The principal question in the cause was, whether these propellers, claimed to have been patented by Mr. Ericsson, were substantially the same as the wheel patented by the plaintiff.

The plaintiff, Mr. John B. Emerson, produced and read to the Jury a copy of his letters patent, dated 8th March, 1834. He proved, by Dr. Jones, that, at the time of filing his specification, he deposited in the Patent Office a drawing of the wheel, and also a model. The original specification, drawing, and model, were destroyed by the fire which consumed the Patent Office in December, 1836.

The counsel for the plaintiff then produced and offered to read a

certified copy of a drawing made by the plaintiff, and filed in the Patent office on the 28th February, 1844; this was objected to by the defendant's counsel, on the ground that the specification did not refer to any drawing, and that none had been annexed thereto—this objection was overruled, and the drawing was put in evidence.

The deposition of Dr. Jones, of Washington, was then read, by which it appeared that the plaintiff came to that city in March, 1844, and had with him the model of his improved wheel; that Dr. Jones was consulted by him, and then advised him that the drawing filed in February was imperfect, and an inaccurate delineation of the wheel; and that thereupon, Dr. Jones prepared a new drawing, with references, which was sworn to by Emerson, and filed on the 27th March, 1844. The counsel for the plaintiff then offered to put this corrected drawing in evidence. The counsel for the defendants objected, upon the ground that the Commissioner of Patents had no right to receive and file more than one drawing, and that by the filing of the drawing made by Emerson in February, the power conferred by the Act of 1837 had been exhausted. The Court overruled the objection, and the second drawing was put in evidence.

The counsel for the plaintiff then produced the model of a ship, with the propeller wheel, patented by the plaintiff, and then read the deposition of Charles Robinson, who deposed that he had made the said model in the year 1837, in New Orleans, and that it had been publicly exhibited for a year, in the Merchants' Exchange of that city, and from thence was taken to the plaintiff's ship yard.

The plaintiff's counsel then called William Serrell, who testified that he was a civil and mechanical engineer. Being shown models of the plaintiff's wheel, and of Ericsson's propeller, he stated that he had examined them, and had been forced into the conclusion that they were essentially the same.

This witness was subjected to a very long and minute cross-examination, which strongly exhibited his accurate and scientific acquaintance with the principles of practical mechanics. He stated, in substance, that the two machines were substantially the same in mechanical construction and action; that he could construct the plaintiff's wheel from his specification. He went into a detailed explanation of the specification, and said, that, taking it as a whole, he considered it sufficiently disclosed that which the inventor intended to construct.

The plaintiff's counsel also called James P. Allaire, who testified that he had been engaged for many years in making steam engines and other machinery; that "Ericsson's propeller" was identical in mechanical construction and effects with the plaintiff's wheel. He examined the specification, and testified that he could from it construct a wheel similar to the models produced in Court.

John C. Kiersted testified that he was a practical mechanic, and that, taking the specification, with either of the drawings filed by Emerson, he could construct a wheel similar to the models. He also proved that the defendants had made and applied "Ericsson's propellers" to a large number of vessels.

Stephen E. Glover testified that he was acquainted with Ericsson's propeller; that he had been interested in his patent, and that the charge for the use of his propeller was three dollars per ton for large vessels, and two dollars and fifty cents per ton for those of a smaller class.

The counsel for the defendants admitted that they had applied "Ericsson's propellers" to six vessels, each of 150 tons, and to one vessel of 340 tons.

The counsel for the defendants then called Dr. Dionysius Lardner, who testified that, before the date of the plaintiff's patent, he had seen propellers in England which had been patented by Mr. Perkins, and also by Mr. Smith. Models of them were produced, but the witness admitted that they differed substantially from the plaintiff's. He testified that the specification was vague and indefinite, and that he could not, from its directions, construct a wheel such as the plaintiff claims to have patented.

The deposition of Charles M. Keller was then read. He testified that he was a clerk in the Patent office; that he had officially examined the two patents of Emerson and Ericsson; that, in his opinion, they were different, and did not conflict; and that he had made a report to that effect to the Secretary of the Treasury.

James J. Mapes and William A. Cox testified that they were consulting engineers, and that they had read the plaintiff's specification; that it was vague and indefinite, and that they could not, from its directions, construct the wheel claimed by the plaintiff. Upon cross-examination, these witnesses stated that they were not practical mechanics.

Joseph Belknap, a draughtsman in the employ of Dunham & Co.; James Cochran, second engineer of the steamer Princeton; and George Birkbeck, jun., a person in the employ of the defendants, stated that they could not, from the specification alone, have constructed the wheel; but that, with the aid of the corrected drawing made by Dr. Jones, they could have done so.

The Court charged the jury, that the patentee is bound to file a specification of his discovery, which shall apprize the public of his invention without ambiguity or uncertainty; that, if they shall find that the plaintiff originally filed drawings, so that all persons might have examined them, and that such drawings were similar to those produced in the trial, then they might come in aid of the specification. He directed the jury to view it as the whole specification, and gather from it what the plaintiff intended to claim. His Honor then examined the terms of the specification in detail, and reviewed the testimony of the witnesses. He instructed the jury, that they must construe the language as addressed to men skilled in this branch of art—and if a competent mechanic could, from it, have constructed the wheel, it is sufficient. If such a mechanic could not, from the specification, have constructed the machine, then the plaintiff must fail, unless he can help it out by the drawings; that these must be shown to have been filed with his original application; that in this case, the Patent Office and its contents having been destroyed by fire, he is

compelled to supply the evidence in the best way he can. The Judge then reviewed the evidence as to the drawings filed in 1844. He further instructed the jury, that it had been contended that Emerson had abandoned his patent to the public by non-use; that this might arise either from positive abandonment, or might be implied from circumstances—and if the jury should find that he had relinquished his right, then he could not maintain this action; that a patentee cannot lie by an unreasonable time, and allow his invention to go into use. The Judge then reviewed the evidence upon this point.

He further charged, that it did not appear to be denied, that if the plaintiff's patent was valid, that the defendants had infringed it; that the jury were bound, if they found in favor of the plaintiff, to give him a verdict for his actual damages; that in some cases the Court had instructed the jury, that they might, in addition, give damages to compensate the plaintiff for the expenses of the litigation—but that, in the present instance, he thought they ought not to find beyond the actual damages proved. He repeated, that the great question in the cause was, had the plaintiff established his right to the wheel commonly known as "Ericsson's propeller?"

The jury found a verdict for the plaintiff for 3,575 dollars and six cents, costs. It is stated that, of the jury, eight were practical mechanics.

Lond. Jour. of Arts & Sci.

Opinion of the Judges of the Circuit Court of the United States in relation to Sales made by Inventors previously to taking out Patent Rights.

It has heretofore been held in the Patent Office that, under the seventh section of the law passed on the 3d March, 1839, the sale of a newly invented article by the inventor, or with his consent, before he applied for a patent, would not invalidate it, excepting such sale had been made for more than two years prior to such application, or excepting on proof of the abandonment of such invention to the public. But by a letter just received from an intelligent gentleman in New York, it appears that, on the 13th instant, in the circuit Court of the United States, in the case of James Wilson *vs.* Austin Packard, it was in evidence that Wilson had sold a stove, the right to which was in controversy two months prior to his application for a patent therefor. On this testimony it was ruled by Judges Nelson and Betts that, if the inventor sells the article which he has invented in the usual way, or if he authorizes another to sell it, he abandons it to the public. That the sale, in the usual way, in a single instance, is a dedication of it to the public. That it is not a question whether the inventor intended to abandon it to the public, but merely what he has actually done. That the idea that a person can sell the thing invented without an abandonment to the public is an absurdity. That if the jury was satisfied that the plaintiff had thus sold, in one instance, before he applied for his patent, they should find for the defendant.

It is to be hoped that an appeal from this decision may be made to the Supreme Court, in order that it may be either confirmed or re-

versed. What was the intention of those who framed the section of the law in question is well known to the writer of this article: in many instances men had labored long and exhausted their means in bringing a machine to perfection, and, by selling this individual instrument, they could procure money enough to enable them to obtain a patent; but, under the then existing laws, such sale amounted to a forfeiture of their rights. It was really supposed by the uninitiated that the law had been changed in this particular, but it now appears that the attempt to do so was a failure, and that the Commissioner of Patents and others filling important stations in the Patent Office have not only misconstrued the law, but have afforded advice and information to inventors which have been destructive of their interests. Whatever may be the final result, should the question be carried up to the Supreme Court of the United States, the only safe course now to be followed by inventors, will be for them carefully to abstain from making any sale before completing their applications in the office.

Since the foregoing was written a further communication has been received from New York, written by a gentleman of the Bar, from which it appears that Judge Nelson charged the jury that the patent was equally avoided by the sale of the stove, on the part of the applicant, *after he had completed his application, but prior to the issuing of the patent.* It is not intended, in the present communication, to enter into any argument respecting the correctness of the instructions given to the jury by the Court. It frequently happens that months and sometimes years elapse between the time of making the application and the completion of the grant. In the case of Wilson's patent, this had extended to full three years, and during this period a number of his stoves had been sold. It is not known to the writer that a legal decision adverse to the safety of so selling had been ever made in our courts. The instructions given by the Patent Office and the words of the Patent law, as well as many decisions under the act of 1793, and that now in force, have quieted the minds of inventors respecting their right to make sales after their applications were before the office; but now all is uncertainty, even on this point, and the validity of a large proportion of the existing patents put in jeopardy.

T. P. J.

National Intelligencer.

ENGLISH PATENTS.

Specification of the Patent granted to Thomas Clark *and* Charles Clark, *of Wolverhampton, in the County of Stafford, for Glazing and Enamelling Cast Iron Hollow Ware, and other Metallic Substances.*— Sealed May 25, 1839.

To all to whom these presents shall come, &c., &c. The nature of our said invention consists in so cleaning and preparing the surface of the inside of the cast iron surface to be enamelled, that when the proper enamelling material is placed upon it and exposed to a proper heat,

the enamel will remain attached to the meta and become properly glazed, so as to withstand the ordinary heat to which saucepans and other the like ware are exposed, without cracking or coming off.—And in further compliance with the said proviso, we, the said Thomas Clark and Charles Clark, do hereby describe the manner in which our said invention is to be performed by the following statement thereof with reference to vessels such as cast iron saucepans (that is to say) :—

Preparation for the Vessels.—Before the application of the enamel, the vessel of cast iron must be well cleaned in the following manner: mix with sixteen or twenty gallons of water, as much sulphuric acid as will render the water sensibly acid to the taste; put the vessel in and let it remain three hours, or even more; then take it out and scour it with sand, wash it twice in clear spring water, and lastly immerse it for five minutes in boiling water; take it out and wipe it perfectly dry, and it is then fit for the application of the enamel, which is composed of two coatings, first a composition for the body, and secondly a composition for the glaze. The first composition is made as follows: one hundred pounds of flint, calcined and ground fine, added to fifty pounds of borax, ground fine also; calcine these together till they are perfectly fused, let them cool, and then take forty pounds of the above, and five pounds of potter's clay, and grind them in water together, and bring them to such a consistence as when the vessel is washed with it that a coating of about one sixteenth of an inch is left in it, forming the first coating, or body, to support the glaze; let this set, which it will do sufficiently in from five to ten minutes, if kept in a warm room. And then the following, or second composition, must be very evenly sifted over it whilst it is yet moist: one hundred and twenty-five pounds of white glass, made without lead, twenty-five pounds of borax, twenty pounds of soda; these must be pounded fine together, and then perfectly vitrified in a crucible, then cooled and ground very fine in water, and afterwards dried; then take thereof forty-five pounds and one pound of soda, mix them together well in hot water, stirring them well; then dry them in a stove, and a fine powder will be produced; when this powder has been very evenly sifted over the first composition, the vessel must be put in a stove at a temperature of two hundred and twelve degrees of Fahrenheit to dry it, after which the composition is fired, by placing the vessel in a kiln, or moufle, such as the China manufacturers use for firing enamel colors; the kiln is brought to a sufficient heat to fuse the glaze, the vessel must then be first heated gradually at the mouth of the kiln, and then put in the full heat till the glaze is fused; it is then taken out to cool gradually. Now, whereas we claim as our invention, the enamelling and glazing of cast iron, as hereinbefore described, so as to enable vessels, so enamelled, to bear the heat to which saucepans, and such like cooking vessels, are ordinarily subjected without cracking or splitting off.—In witness, &c.

Enrolled November 25, 1839.

Disclaimer.—Entered by the said Thomas Clark and Charles Clark, pursuant to the provisions of an Act passed in the 5th and 6th years

of the reign of his late Majesty King William the Fourth, entitled, "An Act to amend the law touching Letters Patent for Inventions:"

We, the said Thomas Clark and Charles Clark, do hereby declare that since the granting of the said letters patent and the enrolment of the specification thereof, we have been advised that it is doubtful whether the said invention is applicable to other metallic substances than cast-iron, and for this reason we, the said Thomas Clark and Charles Clark, do hereby disclaim the words, "and other metallic substances," in the said title of the said patent.—In witness, &c.

Rep. Pat. Inv.

Specification of the Patent granted to JOHN SWINDELLS, *of Manchester, in the County of Lancaster, for several Improvements in the Preparation of various Substances for the purpose of Dyeing and Producing Color, also Improvements in the Application and Use of several Chemical Compounds for the Purpose of Dyeing and Producing Color not hitherto made use of.*—Sealed June 12, 1844.

To all to whom these presents shall come, &c., &c. One part of my improvements in dyeing and producing color consists, when madder, madder-root, or munjeet, is made use of to produce some given color, in preparing the madder as follows:—I take any given weight of my madder, and, when reduced to a fine powder, I mix the same with as much of a solution of caustic ammonia, potash, or soda, as will thoroughly carbonize the yellow or fawn coloring matter therein. Different kinds of madder require different proportions. What is called best French madder requires one-eighth part of its weight of caustic alkali, or of ammonia, as much of the solution as will be equivalent in saturating a given weight of an acid, as the one-eighth of potash. I thoroughly mix any of these solutions with the powdered madder, and expose them to heat not exceeding 175° Fahrenheit: this, when dissolved in water, will be ready to operate with in dyeing or forming madder, lakes, or pinks; or the madder may be first treated with sulphuric acid, as in making guarancine, and the alkali afterwards applied, which will not then require to be operated on by heat, but simply dissolved in a solution of any of the alkalies, or their carbonates, or other salts thereof; but I prefer, for any of these purposes, caustic solution of ammonia as producing the best effects. In dyeing cottons or linens with this prepared madder, or with the common kinds, as also with other vegetable matter, I prepare the cotton for receiving the color as follows:—After it has been bleached or thoroughly cleansed from impurities, I steep it for some hours in a solution of gelatine or albumen (the strength of solution which I prefer is a specific gravity of 1.04.) After removing from this, I pass the goods into a strong solution of tannin for twelve hours. I then wring them out, and dry thoroughly, either in the air or a stove. This process may be repeated or not, according to the depth of color required.

I then go through the remainder of the processes of dyeing in the usual manner.

My next improvement consists in preparing, for dyeing blues and similar colors, the compounds of cyanogen and ammonia, as follows: My first improved method consists in preparing a substitute for the hoof and horn, and other animal materials usually made use of.—This I accomplish by grinding to a fine powder or paste common coal, cannel coke, or charcoal, or any other carbonaceous matter, and mixing therewith a solution of gelatine, albumen, or a mixture of each, and, thoroughly drying the compound, I use it in the same way as the hoof and horn is now made use of. My second improved method of producing the compounds of nitrogen, namely, cyanogen, or prussic acid, and ammonia, consists in combining nitrogen gas or the oxides of nitrogen with carbon, as follows:—If nitrogen be made use of, it may be produced from the atmosphere, or from any of its compounds or mixtures, passing it through heated carbonaceous matter of any description; but I prefer charcoal or coke, so as to form oxygen, (if it be atmospheric air,) into carbonic acid. To accelerate the process, I propel or force the mixed nitrogen and carbonic acid through lime, by means of appropriate machinery, either in a semifluid state or in the state of hydrate, or it may be passed through solutions of any alkali or alkaline earth, so as to combine the whole of the carbonic acid therewith, and also condense any aqueous vapor that may be present; nitrogen gas, moderately free from other gases, will then remain.—This nitrogen I then pass through charcoal, or any carbonaceous matter previously saturated with potass or soda, kept at a full red or approaching a white heat, in a perfectly close retort, or any other convenient apparatus, until the required quantity of cyanide is produced. If ammonia is to be produced, I pass the nitrogen gas, together with one-fourth its volume of steam or aqueous vapor, through charcoal or other carbonaceous matter at a red heat, and condense the ammonia so produced by the usual process or processes, or atmospheric air may be made use of along with aqueous vapor, and passed through heated carbonaceous matter at a red heat, either in close or open vessels.—If the protoxide, deutoxide, or nitrous vapor be operated on for the production of cyanogen, I proceed, as before described, in operating with nitrogen gas; or the process of separating the oxygen may be dispensed with, and by making due calculation of the quantity of oxygen in the compounds of nitrogen operated on, adding potass or soda sufficient to combine with the carbonic acid which will be produced in the process when passed through the heated carbonaceous matter. In forming ammonia, or its compounds, from the oxides of nitrogen or nitrous vapor, I pass them, in conjunction with their own volume of steam, through charcoal or other carbonaceous matter at a red heat, either in close or open vessels. But if a compound of carbon and nitrogen, namely, cyanogen, is to be formed or produced, the apparatus containing the heated carbonaceous matter must be air-tight. I wish this to be minutely attended to, as it is necessary to the process of producing cyanogen to exclude oxygen, carbonic acid, or aqueous vapor, and constitutes the difference betwixt a process some time ago

patented, for producing cyanogen by pumping atmospheric air through heated charcoal, and my process, as before described.

My improvement, in applying several chemical salts or compounds in dyeing or producing color, consists in using or operating on a class not hitherto used for these purposes. In dyeing or producing color from the cyanides, ferrocyanides, or other compounds or salts of cyanogen, I separate the acid required from its combination with barium, strontia or calcium; but of these I prefer the salt of barium, which I operate on by precipitating the barium by its equivalent quantity of sulphuric acid, diluted with as much water as may be necessary to produce the required strength of acid to be made use of. My improvements also consist in the application of the chromates and bichromates of barytes, strontia, and lime, whose bases I also separate by an equivalent proportion of sulphuric acid and water according to the strength of the solution required. In operating on manganic salts, I make use of the manganate of barytes, strontia, or lime, and separate the base by an equivalent quantity of sulphuric acid and water, as already described in preparing chromic acid. The solution of the acids of chrome and manganese, when separated from their bases, I apply in raising, dyeing, and oxydating various colored fabrics.

I claim therefore as my invention—

Firstly, the use of ammonia, or other alkalies, for preparing a madder dyeing liquor.

Secondly, I claim the process of preparing cotton or linen by subjecting them to the action of gelatine or albumen and tannin.

Thirdly, I claim the method of preparing materials for the manufacture of cyanogen of prussiates by using gelatine or albumen mixed or ground together with carbonaceous matter of any description.

Fourthly, I claim the production of cyanogen and its compounds by operating on nitrogen gas, after having removed any other gas or aqueous vapor therefrom, before introducing it to the heated carbonaceous matter.

Fifthly, I claim the production or manufacture of cyanogen or its compounds by operating on the oxides of nitrogen or nitrous vapor, however procured, by bringing them in contact with heated carbonaceous matter, either after having separated the oxygen or without separating it.

Sixthly, I claim the production or manufacture of ammonia, or its salts, by operating on the nitrogen of the atmosphere or any other oxides of nitrogen, in conjunction with aqueous vapor, and passing the same through heated carbonaceous matter.

Seventhly, I claim the application or use of the cyanide, ferrocyanide, or chlorocyanide, or any other combination of cyanogen and barium, strontia or calcium, in dyeing, printing, and producing color.

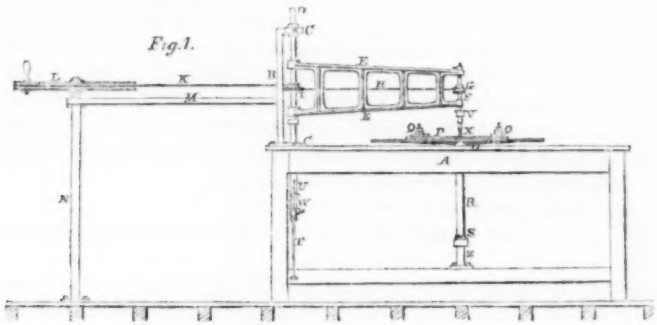
Eighthly, I claim as new the use and application of chromate or bichromate of barytes, strontia, or lime, for the purpose of dyeing, printing, and producing color.

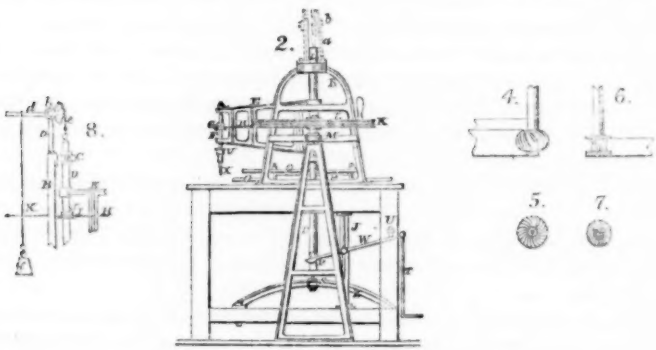
Ninthly, I claim also the use and introduction of the manganate of barytes, strontia, and lime for the same purposes.—In witness, &c.

Enrolled December 12, 1844. Rep. Pat. Inv.

To WILLIAM IRVING, *of Lambeth, engineer, for improved machinery and apparatus for Cutting and Carving Substances to be applied for Inlaying and other purposes.*—[Sealed 25th November, 1843.]

This invention consists in certain improved constructions or arrangements of machinery, having a revolving cutter, by means of which, in conjunction with a movable table, tablets of wood and other materials can be cut away, carved, countersunk, and perforated, in various ornamental forms, with great facility, for the production of inlaid devices, gothic tracery work, and other kinds of ornaments hitherto usually wrought by hand.





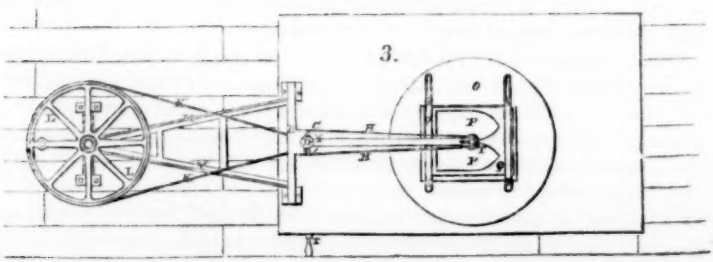


Fig. 1 represents a side elevation; fig. 2, an end elevation; and fig. 3, a horizontal view of the machinery. A A, is a bench, or table, for supporting the several parts of the machine; B, B, is a standard, or bracket-frame, firmly fixed to the said bench; which frame is provided with plummer-blocks and bearings C, C, to receive a spindle D. E, is a forked frame, or swinging arm, firmly fixed upon the spindle D; and the other end of the arm E, is furnished with suitable bearings, which carry, in a vertical position, a spindle F. The lower end of this spindle F, is formed to receive a chuck V, or other suitable contrivance, for attaching and holding securely, the tool, drill, or cutter X, or such other cutter as may be required; and upon the spindle F, near its upper end, is fixed a conical pulley G, having grooves of different diameters, for the purpose of determining the velocity with which the spindle shall be made to revolve. This pulley is designed to receive an endless band or cord H, which passes round the lower part of a similar pulley I, running loosely upon the spindle D; the upper groove of the pulley I, is made to receive another endless band or cord K, that passes around a wheel or drum L, supported by a standard or frame N, which is connected, by a similar frame M, to the standard B; but the band K, may be driven by any other means. O, is a horizontal movable table, mounted upon a vertical shaft, R, which passes through the bench A; its lower end being supported by, and turning freely upon, a step or bearing S, in the arch Z, fixed to the framing of the bench. The tablet or slab of wood, or other material, intended to be wrought by the cutter X, is to be placed upon the turning-table, as at P, and made fast thereon by screwed clamps. At the left-hand end of the bench A, there is a vertical bar J, made fast to the wood framing, in which there is a fulcrum-pin for the lever W, to turn upon; one end of this lever W, is formed into a concave socket to receive, as a step, the lower end of the spindle, D, before mentioned; and the other end of the lever is connected, by a joint, with a treadle-rod T. This treadle-rod and lever are for the purpose of raising, when required, the spindle D, with the forked frame E, carrying the drill. U, is an adjustable screw, set in the leg of the bench, as a stop to the lever intended to regulate the descent of the spindle D, with the frame E, in order that the cutter X, shall not penetrate deeper into the material, or substance P, than may be desired.

Fig. 8, and the part dotted in fig. 2, represents another arrangement for raising and lowering the spindle D, with the forked frame and drill, instead of the lever and treadle-rod, before described: this arrangement is used when the carving of variable relief, such as foliage, figures, &c., is required to be executed.

Upon any convenient part of the standard B, is fixed a frame *a*, with bearings *b*, *b*, to receive and support the axle of a quadrant *c*, which has a lever *d*, attached to its centre. From the periphery of the quadrant *c*, is suspended, by a chain *e*, or other suitable contrivance, the spindle D, carrying the forked frame E, with the drill. To the lever *d*, a weight *f*, is suspended by a rod, or other convenient means, hung in any of the notches provided in the lever for that purpose; which weighted rod acts as a counter-balance to the spindle D.

and the several parts attached thereto; thus enabling the cutter x, to be raised or lowered with the greatest facility and precision: all the other parts of the machine, and their action, being the same as hereinbefore described.

Fig. 4, is an elevation, and fig. 5, an under side or end-view of a tool or cutter, for cutting or carving a semi-circular or quarter-round hollow, for mouldings, gothic tracery, &c.; fig. 6, is an elevation, and fig. 7, an under side or end view of a tool or cutter, for cutting or carving a bead and fillet, or astragal. These are only two examples of cutters, but, of course, a great variety may be employed, and these must depend upon the form of the edge of the recess intended to be cut or formed; as any and every variety of rounds and hollows, ovolos, ogees, &c.; separately or combined, may be executed, not only in straight lengths, but to the form of any regular or irregular curve that may be desired.

The mode of cutting or carving with this machine is as follows:—Upon the revolving table o, the tablet, slab, or piece of wood, or other material p, to be cut, or carved, is fixed; and on its upper surface, when desired, is placed a template or pattern q, (formed of iron, brass, or other approved material,) of the design required to be cut or carved; and the two are firmly held upon the table o, by cramps, or cramping-bars, as shown. Motion being given by any convenient power to the wheel or drum l, or communicated by any other means to the band or cord k, the pulley i, will be made to turn rapidly upon the spindle d; by which means the band or cord h, passed round the pulley g, will cause the spindle f, carrying the cutter x, to revolve with great speed; the velocity of the cutter being determined by the proportions which the diameters of the pulleys g, and i, bear to each other, and the speed of the driving power. The cutter x, being set to the depth of cut required, by adjusting the stop u, the workman presses down the treadle-rod t, with his foot, which causes the lever w, to raise the spindle d, with the cutter x, and the several parts attached thereto; thus the forked arm e, is raised, and being moved around the cutter x, may be passed over the tablet p, in an arc; at the same time the movable table o, must be turned, so that the cutter may be perpendicularly pendant over the part of the tablet where the work is to commence. The revolving cutter x, is then let down, by removing the pressure from the treadle-rod t, and it immediately penetrates into the tablet. The form in which the cutter moves over the tablet is now to be determined by guiding the shaft of the cutter against the edges of the template or pattern; the table o, with the tablet p, upon it, being moved at the same time, in order to keep the edge of the template always close to the shaft of the cutter. By thus moving the swinging-frame e, and the table o, various arcs of circles, that are constantly tangential to each other, may be traced upon the tablet under operation; thereby enabling every possible variety of regular and irregular, curved and straight forms to be cut or carved in the material acted upon; and this combined or simultaneous action forms the principal novelty of the invention.

The patentee claims the combination and application of the several

parts, as herein shown and described, and any variation of that combination or application, for effecting the principle of his invention; provided the swinging-frame, which carries the cutter, and also the table on which the article to be wrought is placed, have both the means of circular motion.—[Enrolled May, 1844.] Lond. Jour. of Arts & Science.

Specification of a Patent granted to Edward Guigues, *of the county of Surrey, for improvements in Printing on Leather and Skins, being a communication.*—[Sealed 17th October, 1844.]

The improvements in printing on leather and skins, which constitute this invention, are as follow:—The patentee takes goat, sheep, or other hides, tanned, by preference, with Sicilian sumach, and washes them in water, to remove all oily matter, and any sumach that they may contain. For one dozen skins, a pint of sulphuric acid, of 66° Baumé, and 12 gallons of water, heated to 90° Fahr., are put into a tub, and in this liquid the skins are immersed for ten minutes; they are then immersed in the same quantity of cold water for a quarter of an hour, after which they are placed upon a table, and by the process of "striking out," nearly all the water is extracted, and they are hung out to dry; when about half dry, the skins are laid, one above another, upon a table, and brushed smooth, in order that they may be more easily printed upon; and after remaining on the table for a day, they are ready for the printer.

The printing-table, and the accessories, are the same as when printing on stuffs and other fabrics; but the modes of preparing the colors are different. The following solution is mixed with all the colors, to render them unalterable and proof against acids:—Half a gallon of muriatic acid, of 81° Baumé, and a quarter of a gallon of aquafortis, of 36° Baumé, are introduced into a flat bottle with a long neck, termed a "matrass," which bottle is placed upon an oven, heated to 100° Fahr., and gradually raised to 150°; then 1 lb. of sal-ammoniac is cut very fine, and, every two minutes, 1 oz. of it is put into the bottle, until all is dissolved; then 1 lb. of granulated tin is divided into twenty equal parts, and one part is introduced into the bottle every ten minutes. As soon as the tin is perfectly dissolved, the bottle is taken off the oven, and the solution allowed to "fine" during two days; at the expiration of which, it is poured into a bottle, and kept tightly corked.

The colors are prepared in the following manner:—For red, 4 lbs. of Brazil chips are put into 4 gallons of salt water, and boiled for six hours; then the liquor is passed through a sieve, and allowed to remain for a month before being used: to every pint of this liquid color, one-fourth of a pint of the solution, above described, is added. Violet is made by substituting Campeachy chips for the Brazil chips; the color is ready for use immediately after straining; and the solution is added in the same proportion as to the red. Yellow is produced by using Persian berries; and the color is ready for use when cool. Other colors are prepared in like manner.

After the skin has been printed, and is perfectly dry, it is dipped into cold water, and then into water heated to 100° Fahr., (to which

sulphuric acid has been added, in the proportion of 1 pint to 12 gallons of water;) when the skin has remained in the latter for three minutes, it is withdrawn, and soaked in cold water for ten minutes; it is then laid upon a table, and the water extracted by the process of "striking out;" after which, the surface is smoothed over by hand, with linseed oil, and the skin is hung up to dry; when dry, it may be polished in the ordinary manner.

The patentee claims "the mode of printing leather and skins, by the use of a preparation of the materials as herein described."—*Enrolled April*, 1845. Ibid.

BIBLIOGRAPHICAL NOTICE.

FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

A Treatise on the Steam Engine, by the Artizan Club—to be completed in twenty-four monthly parts—illustrated by Steel Plates and Wood Cuts. Published by LONGMAN, BROWN, GREEN & LONGMAN, London. *Price, 1 shilling per number.*

We have always thought that the history of the steam engine, from its first crude elements to its present elaborate and varied form, was the best means of illustrating its construction and principles, and have, therefore, much pleasure in noticing that such has been the course of the new periodical, entitled "A Treatise on the Steam Engine," by the Artizan Club, of which work we have received the first nine numbers.

In glancing over these numbers, it is evident, that a vast amount of useful information has been concentrated in a very small space, and that the matter has been collected in a systematic form.

A brief space has been devoted to the history, with descriptions and illustrations, of the structure of the early attempts, from which has grown to maturity, this all powerful agent, each step of which, is perspicuously described and exhibited. The work then proceeds to the discussion of principles, with useful illustrative tables; each number having a well engraved plate, of an engine, of modern construction, for mining, marine, or locomotive purposes.

The work then proceeds to the structure of furnaces, boilers, and to fuel, with smoke consuming arrangements, &c.; with numerous cuts, of a legible character, taken from authentic examples.

If this work is continued in the style in which the numbers before us have been conducted, of which we have no doubt, from the ability thus far displayed, it will furnish the mechanician with the means, in a collected form, of making himself thoroughly acquainted with the structure of the steam engine in all its phases, and will give him a plain and practical illustration of all its principles.

Our time will not admit, even if we were so disposed, to enter into a critical examination of the various tables and formula contained in these numbers, but we have no doubt that those who have the inclination and ability, will find both pleasure and profit in an examination of them; and we are sure that the mechanicians and engineers of

our country will derive much pleasure from the information contained, and promised, in the published and forthcoming numbers of this useful periodical.

FRANKLIN INSTITUTE.

Costill's Cast Iron Screw and Nut, for Bedstead Fastenings.

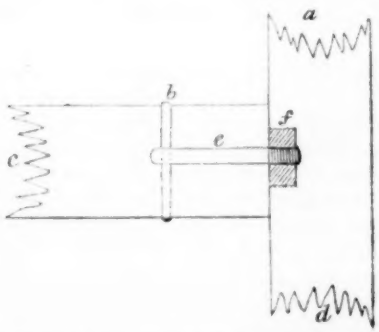
The Committee on Science and the Arts constituted by the Franklin Institute of the State of Pennsylvania for the Promotion of the Mechanic Arts, to whom was referred for examination a Cast-Iron Screw and Nut for Bedstead Fastenings, invented by Stacy Costill, of Philadelphia, Penna., REPORT:—

That hitherto, the swelled beam windlass bedsteads have had male screws formed on the ends of the wooden rails, right and left, so that by turning these rails by a simple wrench, the rails and posts could be successively brought into contact, so as to form the ordinary four-post bedstead.

This arrangement is liable to some objections, which would apparently be obviated by forming the male screw of iron, and inserting, also in the post, a nut of the same metal.

Precisely this object is attained by this contrivance of Stacy Costill, who casts, in suitable flasks, a male screw of *cast iron*, of about three-quarters of an inch in diameter, and four and a quarter inches total length; the thread of the screw being three-quarters of an inch in length, the remaining three and a half inches forming a cylindrical shank, which is inserted into the body of the rail, and is therein confined by an iron pin.

The female screw—*similarly cast*—is, in fact, a cylindrical nut, having both an *interior* and an *exterior* thread; the interior receives the screw before mentioned, which projects its length from the end of the rail; and by the exterior thread, this cylindrical nut is screwed into the post, being turned by a square bit, of which the corners catch into notches formed across the threads of the interior screw.



a d, post of bedstead.
c, rail of bedstead.
b, pin through shank.
e, shank of screw.
f, cylindrical nut.

The cheapness, strength and permanence of this kind of fastening, and the ease with which it admits of adjustment, by propelling or withdrawing the cylindrical nut, with the square bit, recommend

this arrangement to the notice of cabinet makers, and induce us to give it our approbation.

We must, however, recommend, that a wrench with a square end, adapted to the management of this contrivance, should in all cases be furnished by the maker, with bedsteads so constructed.

By order of the Committee, WM. HAMILTON, Actuary.

Philadelphia, January 9th, 1845.

Savery & Co.'s Enameled Cast Iron Ware.

The Commitee on Science and the Arts constituted by the Franklin Institute of the State of Pennsylvania, for the promotion of the Mechanic Arts, to whom was referred for examination specimens of Enameled Cast Iron Ware, manufactured by Messrs. Savery & Co., of Philadelphia, Penna., REPORT:—

That, they have examined the ware, both by inspection and by mechanical and chemical experiment. The two articles more minutely examined were a griddle, or baking-iron, and a small pot for boiling liquids. The mixture composing the enamel consists, probably, of silex, clay, flint glass and borax; and the two articles seem to have been differently coated, for they withstand chemical and mechanical action differently. The enamel on the griddle is superior to that of the pot, and was severely tested, by placing it directly on a hot fire and throwing water on it, which had no effect in loosening or cracking the enamel. On breaking the enamel, subsequently, with a hammer, but a small particle was removed at each blow, and even after the subjacent surface of iron had been exposed, the hammer still continued to remove only small fragments. The enamel, therefore, possesses considerable toughness, is very hard, and adheres with great firmness to the surface of the metal. Nor could openings or pores be detected in it which extended to the metal, and might loosen the adhesion after continued use and cause the enamel to scale off. The surface of this enamel was as smooth as is desirable for the purposes for which it is designed, and it possessed a sufficient degree of whiteness.

The glazing of the pot was more rough on the surface, less white, covered with numerous small black specks, or spots, and a number of small holes or pores were detected, into which a pin might be thrust to the subjacent iron. Muriatic acid heated in the pot for 15 minutes dissolved but little iron, although when nitric was added to it, a large proportion of iron was dissolved, in the cold, in 24 hours. A portion of the iron dissolved was, probably, due to the black specks above mentioned, for after removing the acid, the surface was much more free from them, but a portion was also due to iron dissolved out through the small pores. For by putting the acid in one part, where a single pore was observed, and letting it remain for a few days, the glazing scaled off readily around the pore. It should be observed, that the glazing could be picked off piece-wise, by a knife, when the pot was first examined, previous to the chemical tests.

Additional experiments, with a larger enameled iron pot, proved its glazing to be of fair quality, having the desirable physical qualities of hardness, toughness and whiteness, and offering sufficient resistance to acids. It still presented the defect of pores, observable in the smaller pot.

In the opinion of the Committee, if the griddle alone should be considered as an example of the ware, it is of superior quality, being white, smooth, hard, tough, adhering with great force to the iron, and presenting great resistance to chemical agents. If the smaller pot be the standard, the ware is not perfected. If we draw conclusions from both specimens, it is that the manufacturers are capable of producing an article of the best quality, but that the products of their manufacture are not always uniform. If the ware could always be made of the same quality with the griddle, it would deserve high commendation.

The presence of flint-glass in the composition is decidedly objectionable, for its content of oxide of lead will be a constant cause of a darkening or blackening of the surface when some liquids are introduced into an enameled vessel and heated in it. It will, therefore, be the manufacturer's interest to substitute a leadless glass for flint-glass, which is successfully done in England and on the continent of Europe. But the presence of lead is objectionable on a higher ground, viz: its injurious effects when introduced into food, which may readily take place, especially where much alkaline matter is present in the enamel. Now, although a small quantity of lead in the glazing might not be injurious, yet it would be easy to introduce a larger quantity; a temptation to which the manufacturer is exposed from its greater economy and fluxing power. It is therefore advisable to reject its use altogether.

The use of borax presents the advantage of cleansing the surface of iron more or less during the fusion of the glaze, and causes the whole body of the glazing to adhere more firmly to the metal; but the previous cleansing of the surface of metal by acid or acid salts should not be dispensed with.

By a careful selection of pure quartz and kaolin, which may be termed the body of the glaze, and by a careful fusion of the materials, the glaze may be obtained perfectly white, and free from the black spots alluded to in the above ware.

Lastly, by the successive applications of a finely powdered glaze, that is, by two successive fusions, its surface will be rendered more smooth and beautiful in appearance, and less liable to the formation of pores.

By order of the Committee,

WM. HAMILTON, Actuary.

Philadelphia, April 10th, 1845.

A Mode of Tanning Leather by means of a Flagellator.

The Committee on Science and the Arts constituted by the Franklin Institute of the State of Pennsylvania, for the promotion of the Mechanic Arts, to whom was referred for examination a mode of Tanning Leather by means of a Flagellator, patented in June, 1844, by Robert Downey, New Albany, Floyd County, Indiana, REPORT:—

That the object of the invention is to diminish the length of time

required in tanning, an object which has been kept in view of tanners during the last half century of general improvement in the arts, as witnessed by the almost numberless patents issued in various parts of Europe and the United States, during the time specified. These attempts have been successful to a very limited extent, since the general experience has been that in proportion as the time is diminished, the quality of the tanned leather is injured, or, up to a certain point, the quality is inversely as the time employed in tanning. Nevertheless, at the present time, it would be wrong to assert that a more rapid process, compatible with quality, cannot be devised.

Mr. Downey proposes *flagellation*, as the means of diminishing the time, on the assumed principle that the pores of the hide are closed in the ordinary tanning process, preventing thereby the entrance of the bark liquor. By flagellation with a machine, he believes that the hide is raised and thickened, the pores opened, and while the gelatin and gluten are oozing out, the bark liquor is driven in.

Without farther noticing the mistake in confounding gelatin and gluten, we observe two principles assumed; 1, "the closing of the pores by bark or its infusion;" 2, "the oozing out of gelatin."

1. The committee cannot agree with the proposition that the pores of the hide are closed, certainly not closed in such a manner as to prevent the solution of tannin from entering into them, and they confidently believe that all experience shows that the pores are open and remain so; for the length of time required in the ordinary process cannot possibly be ascribed to the extreme slowness of infiltration through closed pores. Where hides are suffered to remain too long in the *handler*, or on a *layer*, especially during the warm season, without renewing the supply of fresh bark, a species of fermentation produces a mucilaginous or slimy coating, which closes the pores more or less effectually, and this may be viewed as the only case in which a closing of the pores takes place.

2. The "oozing out of gelatin" is erroneous; for the practical tanner knows of no case of the loss of gelatin by mechanical means, and it may be shown to be impossible on chemical grounds. The gelatin does not exist ready formed in the hide, but by the action of hot water the tissues are transformed into gelatin, and the same takes place slowly during the operation of tanning, lapse of time with the conjoint action of tannin in solution performing the transformation which heat effects rapidly. But, on the other hand, admitting the proposition to be true that flagellation presses out gelatin, the tanner can show that it would be positively injurious; for the leather would not exhibit that increase in weight which it is his aim to produce, not merely for the increased profits due to the greater number of pounds, but because this increase in weight increases the firmness and durability of the leather. Gelatin combines with a certain proportional quantity of tannin constituting leather; hence, when a portion of the former is lost, there is nothing to replace it, for the remaining gelatin will only take up its due proportion of tannin and no more, and all other matter added to restore the lost weight would be mechanically

intermingled or lodged in the leather, while nothing can compensate for the loss of firmness and durability.

The committee would state that no samples of leather having been offered them prepared by Downey's process, they have judged of the value of the process on general principles.

By order of the Committee,

WM. HAMILTON, Actuary.

Philadelphia, April 10th, 1845.

MECHANICS, PHYSICS, AND CHEMISTRY.

The Progress and Present State of the Daguerreotype Art. By M. CLAUDET.

The discovery of a new art founded upon some startling facts in science, however perfect it may appear at the beginning, and little subject to improvement, rarely remains long stationary; and still more rarely can we foresee all its useful applications.

As this observation applies particularly to the ingenious and curious discovery of Daguerre, it may be interesting at the present moment to examine the progress it has made during the last four years, and to determine its present state, in order that we may be able to compare, at given periods, the various stages of improvement through which photography has passed.

The daguerreotype has opened two extensive fields of inquiry: the one, for the investigation of facts, by which the sciences are to enrich themselves, and by which some of the phenomena of the laws of nature may be explained; the other, for the advantage of society, in reference to the creation of a new branch of manufacture, and to a new art, which are destined to give employment to many persons; to which may be added the improvements that the daguerreotype will introduce in the fine arts.

It has been remarked that the discovery of photography was as great a step in the fine arts as that of the steam engine in the mechanical arts. There is no exaggeration in this observation; and certainly our age (which is the era, not of wars and conquests, but of social improvements, of emulation in the arts, sciences, and manufactures,) will be celebrated in future times for this extraordinary invention.

It is curious to observe how rapidly sometimes new discoveries are followed by other important discoveries, forming the links of a mysterious and infinite chain, one end of which approaches the great Creator of all things.

In the year 1811, Courtois discovered the chemical substance called Iodine, and, as late as 1826, Balard discovered Bromine; these two elements are the only substances which, in the daguerreotype, form with the silver a compound sufficiently sensitive to the rays of light, and without which substances the daguerreotype could not have existed.

Such is the progress of science, that there is no fact, however insignificant it may appear at first, which does not aid the advancement of philosophy, and the improvement of mankind.

When these new elements were first discovered, how little was it thought that they would so soon become the source of the magic invention of the daguerreotype, which again will undoubtedly lead to other discoveries, perhaps far more important than itself!

There are some persons who, although admiring the daguerreotype in its effects, perceive nothing beyond the mere spontaneous, although beautiful reproduction of objects—the representation of a building or a landscape in their minutest detail, and in the portraying of human features: but this is only the useful and immediate application of the art in its state of infancy; its destinies are of a much higher order.

It may be said that already optical science has been much benefitted by it. Never before has it been found so necessary to construct object glasses with the shortest possible focus, without increasing their aberration; this has now been done, and we have double achromatic object-glasses refracting a perfectly well-defined image upon a screen of seven inches in diameter, although the focal length is not more than eight or nine inches: this improvement in the object-glasses of the camera obscura, being also applicable to the construction of telescopes, will enable opticians to make powerful instruments of a considerably smaller bulk.

The science of optics, the study of which was confided almost exclusively to professional opticians and astronomers, is now in the hands of a thousand operators in photography, who are constantly studying and endeavouring to correct the imperfections of their apparatus; and their researches and investigations will, no doubt, ultimately lead to many useful discoveries.

In passing from the practical part of optics to that which is purely theoretical, that which treats of the various rays emanating from the sun, of their laws and properties, and of the principles and phenomena of light, considered as a whole, or a compound of various kinds of matter (if I may be allowed the expression,) as being produced by emission or by undulation; if these interesting points are ever better explained and understood than they are at present, it appears highly probable that the daguerreotype will be the instrument leading to these results: at least it is certain that, in experiments and researches upon this subject, philosophers will be greatly assisted by the innumerable facts collected in the daguerreotype operation.

The existence of invisible or chemical rays is proved by the various processes of photography; for in speaking of the daguerreotype, we cannot omit to mention the beautiful discovery of Mr. Talbot, which he has called the Calotype. Neither must we omit the curious discoveries of Sir John Herschel, forming another step in photography, which is called by that learned astronomer Crysotype.

The experiments made in these various photographic processes all agree in the fact, that the rays which produce a change upon the sensitive screen are not the rays of light, but other rays traveling with light, and emanating from the same source, which are sometimes more

refrangible than the violet rays, and less refrangible than the red rays under other circumstances; by which it would appear that there exist chemical rays on each extremity of the spectrum: but many facts seem to prove that there is also another kind of ray which is refracted to all parts of the spectrum according to the dispersive power of the lens, and following certain laws of refraction which are different to the laws regulating the other rays; so that different kinds of glasses may have the same power of dispersion for the apparent rays, and be endowed with different dispersive powers for the invisible photographic rays.

I am not prepared to develope the facts by which I have aimed at this conclusion, because my experiments are not yet complete enough to furnish a sufficiently plausible and satisfactory explanation of this phenomenon.

From the application of the daguerreotype to the advancement of practical and theoretical optical science, let us consider how this art is likely to benefit chemistry.

In this respect, is it not sufficient to call to mind that some of the elements we have alluded to, viz. iodine and bromine, have been very little investigated by chemists, and that all their properties are not yet known, neither have the whole of their compounds been ascertained? Now that they are so much employed by every photographer, and their effects minutely studied, is it not reasonable to expect that in the hands of the chemist, also, the daguerreotype may become the medium of scientific research?

After having enumerated the advantages which several branches of science have already derived from the daguerreotype, and having hinted at those which they are still likely to derive from new investigations arising out of the same subject, we shall now refer to its connexion with the fine arts.

There is a singular anomaly in the history of the progress of human discoveries. They frequently seem to follow each other in an inverted order, and very often the ingenuity and perseverance of man, through immense labour and research, have produced works which previously existed in nature, and which, had nature been first studied, would have been executed in much greater perfection, with the saving of an immensity of trouble.

After ages of civilization, it is only within the last two centuries that Battista Porta, being in a dark room, observed that an inverted image of outwards objects was represented on the wall, opposite to a small hole in the window-shutter; to the hole he applied a convex lens, and then, instead of a diffused and indistinct image, he was able to obtain a well-defined and clear picture.

This accidental discovery was the origin of the camera obscura. Yet in nature such instruments have existed since the creation of man, for the eye is nothing more than a perfect camera obscura.

If philosophers had only turned their attention to the construction of the human eye, if they had been able to examine its beautiful arrangements, the camera obscura would have been discovered at a much earlier period. The same observation applies to the discovery

of galvanic electricity, and the apparatus by which this principle is developed. There exists in nature the most perfect and complete galvanic battery; and if philosophers had been able to examine the *Gymnotus electricus*, or electrical eel, it would not have been left to chance and ingenuity to discover one of the most splendid phenomena in the circle of science.

In all cases we find, that whatever we at first consider as a new invention existed before in nature: therefore, man invents nothing, he merely discovers that which has long before been produced by the hand of the Creator; and, as Bacon asserts, "man is only the interpreter of nature."

By the judicious combination of black lines or black dots upon white paper, or white lines and white dots upon black paper, artists have been able to represent all objects visible to the eye; the effect is complete and identical.

The laws of perspective are well understood by this simple means.

We thought that such a work was quite artificial, a calculated imitation of nature which was not true, but that we learned, as it were, to read by habit. We thought that a child could no more understand a picture than read a book. But here again art has been invented, and it is only lately that we have found that nature operated exactly as art, and produced the very same effects.

The daguerreotype represents the objects which we see by the same rules, by the very same means, and proves that the objects cannot be represented otherwise than as the painters had represented them before.

If the daguerreotype had been invented before the art of painting, then we should have never doubted its accuracy, and we should not have thought that we were deceived or taken by delusion.

The daguerreotype plate is etched in by nature, exactly (although in a more perfect manner,) as is the plate of copper or of steel by the ingenuity of the engraver.

When we submit a daguerreotype plate to the magnifying power of the microscope, we observe upon its surface an infinite number of small white dots, which are more or less close to each other, according to the predominance of light or shadow in the picture. In fact, the magnified surface of the plate has the appearance of the sky on a bright night; the white parts present an agglomeration of bright dots, similar to the milky way seen through a telescope, which to the eye appears as a white drapery or belt thrown across the sky.

It would not, therefore, have been surprising if the arts of drawing and painting had been the consequence of the daguerreotype; but it is really wonderful that, without the help and the labours of the daguerrean process, drawing and painting should have attained the perfection so conspicuous in the works of the great masters. Indeed that single fact proves, more than any thing else, the greatness of their genius.

However, it was only given to a very few to grasp nature, but henceforward young artists, of less genius, will be able, by studying the effects of the daguerreotype, to produce works of great merit.

We may also assert that the great masters would have been still more perfect in their imitations of nature if the daguerreotype had been known to them. When Paul Delaroche, the celebrated painter, was asked his opinion of the invention of Daguerre, he unhesitatingly declared that "the process of M. Daguerre had given to art many conditions so essential to its perfection, that they would become, even to the most skilful artists, subjects of observation and study;" and, further, that "this admirable discovery was an immense service rendered to the fine arts."

Is it, then, surprising that the announcement of the discovery of Daguerre created among philosophers and enlightened men so great an interest? that it was received with such amazement and admiration? Is it surprising that the government of a great nation should have proposed to its parliament to award to the discoverer a national recompense?

Two centuries ago the daguerreotype art would have been looked upon as the work of witchcraft, but in our age of improvement we are accustomed to extraordinary discoveries; we are capable of admiring and appreciating these huge efforts of genius, and nothing surprises us. The steam-engine, that perfect machine, so well organized (which, as an animal, requires only to be fed to work by itself, and to produce continuous motion,) has been created almost in our own time and under our own observation.

After such a triumph of the genius of man and of modern science, we see no limit to human discovery; and, indeed, we might believe, that the word *impossible* should be erased from language.

The year 1839 gave birth to two discoveries, which, from the similarity of their properties and results, may, with propriety, be called sister arts. These are the daguerreotype and the electrotype, both of which re-produce and multiply in the greatest perfection; the one acting under the influence of light, the other under the influence of electricity; these two mysterious agents seem, in fact, to constitute the soul of nature.

In the case of the daguerreotype light draws—in that of the electrotype electricity models; and although their work seems, at first sight, to have no connexion, still the two act in unison. The daguerreotype image may be repeated to any extent by precipitating metal upon it by the action of electricity, producing another plate upon which the original is imprinted in its various tints; in fact, the two images are so identical in their effect, that it would be impossible, without knowing previously of what metal they were respectively composed, to decide which was the original and which the copy. This curious phenomenon may assist in explaining the nature of the formation of the daguerreotype image; it proves, undoubtedly, that the light and mercury acting together upon the iodide of silver, alters the arrangement of the molecules of the surface so that minute crystals are produced, which, like cut diamonds, present in almost every direction a favorable angle of reflection to the eye, from which cause they assume a white appearance; the electrotype surface, moulded upon these crystals, receives exactly their counterpart,

and the two surfaces are to each other as the relief is to the matrix which has produced it; so that parallel faces having the same angle of reflection for the eye, corresponding parts of the image present identically the same effect; and this curious reproduction of the electrotype illustrates better than any other effect the great perfection of these metallic deposits, and also the infinite minuteness of the particles of metal reduced by the galvanic agency.

The original process of Daguerre consisted in submitting a polished plate of silver to the vapor of iodine, until by the chemical combination of the two a compound was found exquisitely sensitive to the influence of light, so that when the image at the focus of a camera obscura was thrown upon a plate thus prepared, the design was invisible, though certainly impressed; and this latent image was afterwards brought out by the action of the vapor of mercury. This was his process in all its simplicity; and it seemed at first to be but little susceptible of improvement; in fact there appeared to be scarcely any room for alteration, at least to advantage. Nevertheless, the manipulation recommended by Daguerre has been greatly simplified, and rendered more effective; although, strictly speaking, the invention has remained the same, the changes consisting chiefly in modifications of the original operations.

It is always a surface of silver, coated with iodine, exposed to the influence of light in the camera obscura, and then submitted to the vapor of mercury for the purpose of bringing out the image, after which it is immersed in a solution of hyposulphate of soda, to remove by solution all traces of the iodine from its surface. Up to the present time it has never been found possible to alter, materially, any of these fundamental principles.

The improvements introduced have been chiefly in the instruments employed, and in some additions to the chemical parts of the operation; by the first means greater artistic effect has been given to these pictures, they have been rendered more forcible and defined in detail; and, by the last-named improvement, the plates have been made much more sensitive to light, so that the time of the operation has been amazingly diminished. With the original process it was considered impossible to apply the daguerreotype to the production of portraits; for, with the iodine alone, and the long-focused camera obscura which was at first employed, no picture could be taken, even under favorable circumstances in less than about a quarter of an hour; and as the correctness of a portrait produced by this art depends upon perfect immobility during the whole of the sitting, the mere idea of such an application of photography was looked upon as altogether absurd.

But the fact that an image could be obtained in a quarter of an hour, gave the hope that, by improving either the optical arrangements of the camera, or the chemical preparation of the plate, means could be devised to arrive at the grand desideratum, viz. the application of the daguerreotype to portraiture.

It was, however, soon found that, by constructing object-glasses having a shorter focus, the operation could be reduced nearly in proportion to the reduction of the length of the focus, so that, by applying

to the camera an object-glass of three inches focus instead of twelve, the operation was four times shorter, or reduced to about four minutes.

From that moment portraits were taken by the daguerreotype; but still few persons could remain in perfect quiescence during such a length of time, and if they were able to do so, it was only by submitting themselves to a painful constraint, which unavoidably gave to the countenance a most unpleasant expression. Nevertheless this was a step which encouraged the idea of further improvements; and about this time an ingenious optician of New York, Mr. Wolcott, thought of substituting for the refracting glasses a concave mirror, of such an aperture, that a greater amount of light from the object might be concentrated at its focus, where he placed the sensitive plate. By this means he could operate much more quickly than by a refracting apparatus, and thus reduce the time of sitting.

This was another interesting step in the improvement of the art, but such a process was subject to many difficulties and defects, which rendered it inferior to the refracting apparatus. If the mirror was made of metal, it was subject to corrosion, by being constantly exposed to the changes of the atmosphere; if it was of glass, then two images of different focus were formed, the one from the silvered surface, and the other from the surface of the glass, so that a sharp and well-defined image could not be produced. Another material defect, however, of this process was that by necessity, in placing the plate between the object and the mirror it was absolutely necessary to operate upon a very small size, or else the plate would have screened the greater part of the aperture, and the advantage of the increased reflecting area would be lost. Besides, the rays producing the best definition and the most correct image, are reflected from the centre of the mirror, and are precisely those which are lost by the unavoidable position of the plate.

To be Continued.

On the Anthracite and Bituminous Coal Fields in China; the System of Mining, and the Prices of Coal, and Labour in its Production, and Transportation to Pekin. *By* Richard C. Taylor, Philadelphia.

We have seen the recent announcement of the sailing, from hence, of a vessel containing 308 tons of Pennsylvania anthracite, destined for Hong-Kong, in China. Some very natural speculations have arisen from this circumstance, as to the probability of that country furnishing a market for American anthracite. As no details accompany the statement alluded to, we are not in possession of any material facts whereby an estimate can be formed of the probable success of the undertaking, in a commercial sense; and we are not sure but the coal may have been employed for convenience merely, as ballast.

In the East Indies various depots of European coal have been established, for the service of the British government steamers. This fuel, for the most part, it is understood, consists of the anthracitous

and partially bituminous coals of South Wales, of course obtained at great expense. It appears that 5000 tons of English coal, at a freightage of about £2 per ton, are annually imported into Bombay, for the Company's steamers. Bituminous coals have been derived from much less distant sources; among which the Burdwan coal field, in the vicinity of Calcutta, may be named. Mergui Island, also, in the Bay of Bengal, has lately furnished some steam coal to Singapore. The steam ships on the China seas, during the war with that vast country, were supplied from these various sources.

I do not propose to discuss the profitableness, or otherwise, of a Chinese market for our American anthracite. But as during the process of collecting statistical information for a proposed volume on "the geological and geographical distribution of coal and other mineral combustibles," some notes reached me, of an interesting character, which are not generally accessible to the majority of readers, with relation to the Chinese coal fields, it has struck me that a portion of these details, in an abridged form, might be just now acceptable, particularly as the intercourse with that country is on the increase. I venture even to omit, for the present, the authorities for the facts I shall have to communicate; reserving them in detail for the volume adverted to. It must, nevertheless, be premised that to the Jesuit Fathers, the French Missionaries who were permitted to reside at Pekin during the 18th and preceding centuries, we are indebted for details of the highest interest, not alone on this subject, but on many other objects of philosophical inquiry in that little-known region.

It is probable that coal was discovered, and was in common use in China, long before it was known in the western world. It is mentioned by a noble traveler of the 13th century, as abounding throughout the whole province of "Cathay," of which Pekin is the Capital, "where certain black stones are dug out of the mountains, which stones burn when kindled, and keep alive for a long time, and are used by many persons, notwithstanding the abundance of wood."

The good missionaries were fully capable of describing the coals which were supplied to Pekin, since they there erected a furnace or stove, in which they experimented on the properties of those combustibles; particularly with reference to the ordinary domestic uses, and for the warming of apartments and the purposes of their laboratory.

Among the people of Pekin, three kinds are in use.

1. That employed by the blacksmiths. It yields more flame than the other qualities; is more fierce, but is subject to decrepitate in the fire; on which account, probably, the blacksmiths use it pounded in minute particles.

2. A harder and stronger coal used for culinary purposes, giving out more flame than the other sorts so employed; it is less quickly consumed, and leaves a residuum of gray ashes. There are several gradations of these. The best are hard to break, of a fine grain, a deep black color, soiling the hands less than the others. It sometimes is sufficiently siliceous to give fire with steel. Others have a very coarse grain, are easily broken, and make a bright fire, leaving a reddish ash. Another species crackles, or decrepitates, when first placed

on the fire; and falls down, almost entirely, in scales, which close the passage of the air, and stifle the fire.

3. A soft, feebly burning coal, giving out less heat than the 2nd class; consuming more quickly, it breaks with greater facility, and in general is of deeper black than the sorts previously mentioned. It is commonly this description, which, being mixed with coal dust and a fourth part of clay, is employed to form an artificial and economical fuel. This being moulded in the form of bricks and balls are sold in the shops of Pekin. Wagon loads of coal dust are brought to that city for this sole purpose.

The coal merchants have also an intermediate quality, between the classes 2 and 3.

We cannot, in this place, recite the numerous details which are furnished by these intelligent Fathers. Suffice it to add, that nearly the whole of the properties and applications are now in every day use in the United States, and are familiar to all. They are, in fact, the natural results suggested by qualities possessed in common by the combustibles of remote parts of the same globe. Even the modern method of warming all the apartments of our dwellings, which we view as the result of superior practical and scientific investigation, was in use with very little deviation, centuries ago, by the Chinese. Many a patented artificial fuel compound both in Europe and America, has been in practical operation in China, at least a thousand years.

4. Anthracite. Another description of coal abounding about thirty leagues from Pekin, but which was not then in such general use there as the other kinds, is called by the Chinese Che-tan. Che means a stone, but tan is the name they give to wood charcoal. Therefore, according to the genius of the Chinese language, this compound word signifies a substance resembling or having the common properties of stone and charcoal. There can be little difficulty here, in recognising the variety of coal which, in our day, has been denominated anthracite, a compound word of similar meaning.

The Chinese *glance coal* forms a remarkable exception to the unfavourable conclusion prevailing against Oriental coal; and, according to more recent authority than those we before cited, deserves to rank at the head of the list, in respect of its purity as a coke; although, in specific gravity, it does not come up to the character of the Pennsylvania or Welsh fuel; neither has it the spongy texture which contributes much to the glowing combustion of the latter.

So late as 1840, a Russian officer has described the coal formations of the interior, as occupying the western mountain range of China, in such abundance that a space of half a league cannot be traversed without meeting with rich strata. The art of mining is yet in its infancy among the Chinese; notwithstanding which, coal is thought to be at a moderate price in the capital. Anthracite occurs in the western range of mountains at about a day's journey, or about thirty miles, only from Pekin. The coal formation is largely developed, in which thick beds of coal occur. They appear to be of various qualities. Some of this coal, occurring in shale beds, is singularly decomposed, and its particles have so little cohesion, that they are almost reduced

to a state of powder. Beneath these coal shales are beds of ferruginous sand stone, and below those occur another series, consisting of much richer seams of coal than the upper group.

In this range are seen also both horizontal and vertical beds of conglomerate, accompanied by seams of coal, which have the conglomerate for the roof, and diorite or greenstone for the floor. As might be expected, this coal very much resembles anthracite. It is shining, of compact texture, difficult to ignite, does not flame in burning, or give out any smoke. Its substance is entirely homogeneous. Every thing respecting it, leads to the belief that there had been a great development of heat at the period of its formation, or subsequently. The horizontal coal beds are the most important and valuable, and are denominated large; but no greater thickness than three and a half feet is quoted. The blacksmiths and those who work in copper, prefer this coal, on account of the intense heat which it gives out.

Throughout the whole of this mountain range may be continually seen the outcrops of this combustible, where they have never, as yet, been touched by the hand of man.

In those parts of China where wood is very dear, coal is worked on a great scale for the Pekin market; but the process of mining is very little understood by those people, who excel in the preparation of charcoal.

Coal in other parts of China.—The Missionaries and others inform us that coal is so abundant in every province of China that there is, perhaps, no country of the world in which it is so common. The quays at Nankin are stored with the finest native coal. Some of the coal which was brought down to the coast, from the Pekin country, to the Gulf of Pe-tchee-lee, was anthracite, partaking of the character of plumbago or graphite. Coal, apparently of the brown coal species, exists extensively in the direction of Canton; while all the coals seen on the Yang-tse-kiang river, south of Nankin, resembled cannel coal. Nearer to Canton it possessed the comparatively modern character of brown coal. It was abundantly offered for sale in the different cities through which Lord Amherst's embassy passed, between Lake Po-yang-how and Canton, and the boats were largely supplied with it. It is there obtained by means of pits, like wells; and we infer that, like nearly all the brown coal deposites, the beds were horizontal, and at no great depth. A sulphurous coal, interstratified with slate, and in the vicinity of red sandstone, also prevails towards Canton.

Thus, therefore, we possess evidence, the main object which this communication was designed to exhibit, that extending over large areas in China, are beds of tertiary or brown coal, of cannel coal, a dozen varieties of bituminous coal, of anthracite, glance coal, and graphitic anthracite; all of which, for ages, have been in common use in this remarkable country; and have been there employed for every domestic purpose known to civilized nations of all times; including gas lighting, and the manufacture of iron, copper, and other metals.

Mode of Mining Coal in China.—It might be expected that in China, where most of the practical arts have, from time immemorial,

been carried on with all the perseverance of that industrious people, the operations of mining coal would be conducted with some regard to science, in relation to sinking, draining, and extraction. We have, however, good authority, especially in regard to the environs of Pekin, for stating that the process is still in a very imperfect state. Machinery there to lighten labor is unknown. They have not even an idea of the pumps indispensable to draw off the water. If local circumstances allow, they cut drainage galleries; if not, they abandon the work whenever the inundation has gained too far upon them. The mattock and shovel, the pick and the hammer, are the mining instruments—the only ones, in fact, which the Chinese employ in working the coal. The water of the mine is emptied by the slow process of filling small casks, which are brought up to the surface by manual labor. Vertical shafts are not used. In working horizontal coal seams, the timbering is expensive, and the materials cost about 2 copecs per poud,=$8 50 per ton, English wood being sold by weight in China.

The coal, when mined, is put into baskets, and drawn upon sledges, which are raised to the surface by manual strength. Each basket contains about three pouds of coal, and one man can raise about eight baskets in a day. This is equivalent to 1032 Russian pounds, or to 12 cwt. English, per day. The miners' wages are at the rate of 30 copecs a basket; which is equal to 240 copecs [copper currency,] or 46 cents of United States currency, per day; being $0 76 U. S., per ton.

Prices at Pekin.—At the pit's mouth, this coal is sold for 60 copecs per poud, = $4 63 per ton of 20 cwt. It is then conveyed on the backs of mules through the mountains, and thence on camels to Pekin, where the price is 1½ rouble, = 1½ francs, = 29 cents United States, per poud; which, if our calculation be correct, is equal to $11 60 United States, or £2 8*s.* 3*d.* per ton of 2240 pounds English. We perceive, therefore, that the best of fuel is expensive at Pekin, and hence the necessity for resorting to the artificial compounds and substitutes to which we briefly alluded.

There is, however, a kind of coal sold in that city at a much lower price, particularly when it is mixed with one-half of coal dust. This coal, in 1840, sold for one rouble per poud, which is at the rate of $7 75 = £1 12*s.* 3*d.* per ton. It is of indifferent quality, however; giving out but little heat, and is quickly consumed.

The compound fuel, consisting of coal dust and clay, is still prepared after the mode described by the missionaries last century; but its use is chiefly confined to the indigent classes.

Coal Gas Lighting in China.—Whether, or to what extent, the Chinese artificially produce illuminating gas from bituminous coal, we are uncertain. But it is a fact that spontaneous jets of gas, derived from boring into coal beds, have for centuries been burning, and turned to that and other economical purposes. If the Chinese are not manufacturers, they are, nevertheless, gas consumers and employers, on a large scale; and have evidently been so, ages before the knowledge of its application was acquired by Europeans. Beds of coal are fre-

quently pierced by the borers for salt water; and the inflammable gas is forced up in jets, twenty or thirty feet in height. From these fountains the vapor has been conveyed to the salt works in pipes, and there used for the boiling and evaporation of the salt: other tubes convey the gas intended for lighting the streets and the larger apartments and kitchens. As there is still more gas than is required, the excess is conducted beyond the limits of the saltworks, and there forms separate chimneys or columns of flame.

One cannot but be struck with the singular counterpart to this employment of natural gas, which may be daily witnessed in the Valley of the Kanawha, in Virginia. The geological origin; the means of supply; the application to all the processes of manufacturing salt, and of the appropriation of the surplus for the purposes of illumination, are remarkably alike, at such distant points as China and the United States. Those who have read, even within the present month, the account of the recent extraordinary additional supply of gas, and the services it is made to perform at the Kanawha saltworks, must be impressed with the coincidence of all the circumstances with those which are very briefly stated in the previous paragraph, in relation to China. In fact, the parallel is complete.

To the coals and combustible minerals of China, I cannot further advert here. But what a conviction irresistibly presses upon the mind, as to the incalculable utility of the *Railroad system*, and coal mining improvements in such an empire! If ever there were concentrated at one point all the circumstances especially and unequivocally favorable to that system, and imperiously calling for improvements of the character suggested, it seems to be presented in the case of the city of Pekin. Here, with its enormous population of 1,500,000 souls, it is situated only at a day's journey—computed at thirty miles—from an immense region of coal, comprising several varieties. Yet its inhabitants cannot purchase the best qualities of this coal, brought from the mountains on the backs of mules and camels, under $11 60 per ton, and the very worst for less than $7 75 per ton.

Without making unnecessary or invidious comparisons, it might not unreasonably be suggested, that a Pekin railroad, in connexion with the coal mines, would be a far more profitable enterprise in its results, than the transportation of American coals to China.

I will only add one circumstance, which had nearly escaped me. Borneo, "the largest island in the world," which is only twenty degrees due south of Canton, has lately come into repute for the great quantity of coal which it contains, not only accessible to ships along the coast, but extensively occurring in the mountains of the interior. Much information has also been acquired from the natives; and the facts which are already elicited are regarded as of considerable importance, in respect to the facilitating the steam navigation of the China seas.

Philadelphia will, of course, have her share in the enlarged commercial intercourse with China. Would it, then, be asking too much of those who are personally interested in this improving trade, to com-

municate any additional facts, which are either unknown to, or have been omitted by, the author of these scanty notes?

Philadelphia, April 28th, 1845.

[NOTE.—The prices and admeasurements, which are quoted in the foregoing article, were reduced to the United States and English currencies and measures, from the Russian, as furnished by the Engineer Kovanko; who, in like manner, converted them into the Russian from the Chinese standards. In consequence of this triple conversion of standards, additional care has been taken to avoid error in these calculations.]

Description of an Artificial Hand. By SIR GEORGE CAYLEY, BART.

Sir,—About eight years ago, George Douseland, a son of a tenant of mine, had the misfortune to lose his right hand, when I proposed to make him an artificial one, in the hope of rendering his loss rather less severe. The greater portion of this instrument was made, and the whole of it planned, at that time; but the stump was found to be so tender that it could not then be made use of, if completed; and the young man having gone to reside elsewhere, the thing was lost sight of, and was not renewed till about two months ago, when the remaining portion was executed; and he has found it of considerable use to him in his various daily occupations. I send you a sketch and description of this instrument, which is so simple as scarcely to deserve the name of an invention, but trusting that it may be found as useful to others under a similar misfortune, I wish to give it to the mechanical public through your valuable pages.

The instrument can be executed in many ways, though the means of deriving its firm and forcible grasp from the stump must remain much the same in all. Flexible tendons were adopted in the first sketch I made of this instrument, but I shall describe that which is now in use, and subsequently some very essential improvements; and I hope by thus publishing it, to prevent its being pirated and *patented*, as it is quite misfortune enough to lose a hand without being obliged to forego the use of even so humble a substitute, for want of means to purchase it, or otherwise to procure it at an exorbitant price.

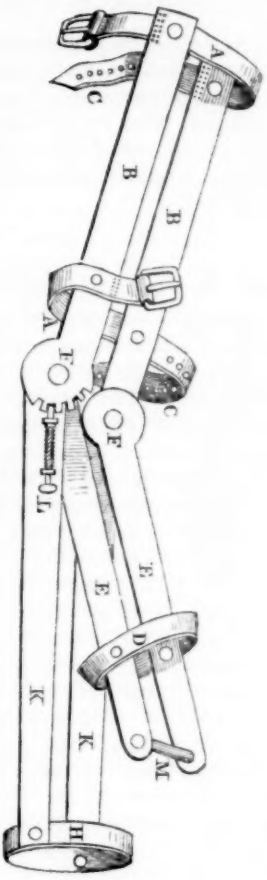
I am, sir,
Your obliged and obedient servant,
March 5, 1845. GEORGE CAYLEY.

Method of making an Artificial Hand, that will forcibly grasp substances of various sizes, and release them at will, so as considerably to supply the place of the natural hand, when that member is lost.

The movements of this instrument, are derived from the stump, by fixing the hand to the upper portion of the arm above the elbow joint, by light frame-work, within which the stump has its movements at full liberty; and by placing a shank or lever, connected with the ma-

chinery of the hand, to the termination of the stump, it is put into forcible and efficient use.

Fig. 1



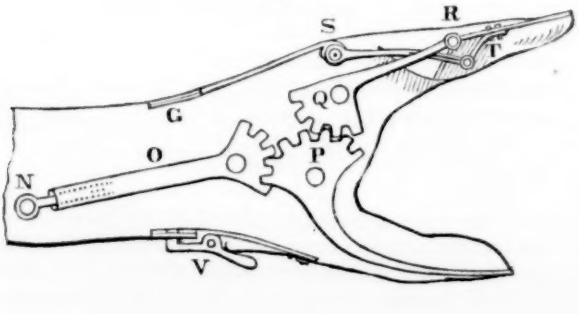
This will be more clearly understood by inspecting the sketch fig. 1, where A A represent metallic half hoops, riveted to the thin steel bars B B, and padded on the inside. When the arm is placed in these semi-hoops, it is secured there by the straps and buckles C C. The end of the stump is at the same time inserted into the padded hoop D, riveted on to the bars E E, which turn freely on the joints F F.

The hand, fig. 2, is fixed to a hoop G, which fits freely into the hoop H, fig 1, at the termination of the arm bars K K, and can turn within it, but cannot escape from it, by means of three small screws working in a groove.

The joints F F, are common to all these bars; but the bars K K can be fixed in any required position by a sliding spring bolt, working into teeth or holes in a circular part of the upper bar B; hence, the horizontal pin, M, is made to move up and down by the muscular motion of the stump.

This pin M is inserted through the eye or loop N, fig. 2, the shank of which slides in the tubular lever O, carrying an arch head, with teeth, and thus moving similar arch heads, P and Q, in opposite directions, the slender shanks of which form, when packed with cork, or other light but firm material, and covered with leather, the thumb and fingers of the hand.

Fig. 2.

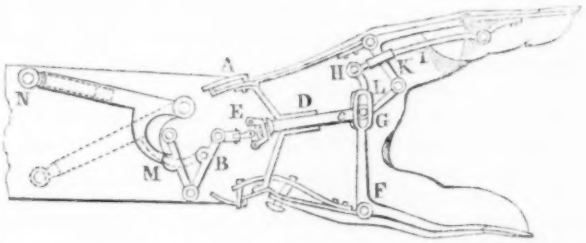


A second motion is given to the fingers at R, fig. 2, by means of a thin rod, or steel tendon, commencing at a stationary joint, S, terminating in a second joint or eye T, and perforating the finger rod near its outer joint.

The whole hand can be twisted round into several positions by the ring on which it is fixed revolving within the outer ring attached to the upper arms; and it is retained in these positions by means of holes, through which a spring catch plays, as seen at V, fig. 2.

There are two considerable deficiencies in this construction, first, that the hand cannot be turned even so much as a quarter of a circle from its horizontal towards a perpendicular grasp; secondly, that there is no movement equivalent to the usual bending of the wrist, which gives so great a variety of positions to the natural hand; indeed, it is not obvious, at first sight, how any other than an horizontal grasp can be given by this instrument, the movement of the pin M being horizontal, and parallel to itself. When, however, the hand is turned up to effect a perpendicular grasp, the action of this pin is oblique to the eye N, which then slides along it, and thus communicates its movement to the hand, full as forcibly as when it is in the horizontal position.

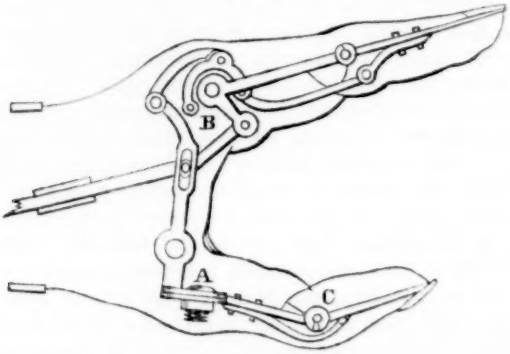
Fig. 3.



To obviate these defects, let the wrist A, fig. 3, be constructed with a hollow ball and socket movement, or other equivalent contrivance, having a range of about the eighth part of the circle; and let this be held fast at any required point by a spring catch as before, falling into a hole in the stationary portion, which must be drilled like a sieve, to suit every position. To the inner or movable portion the hand is fixed; and the movements of the fingers and thumb are communicated from the eye N, through a small rod B, turning on a hinge, and from thence, through a connecting-rod carrying universal joints at both ends, to a cylindrical rod, *c*. This rod slides freely in the tube D, and can permit one of these universal joints, E, to turn freely in a groove round it. The motion of the thumb piece F, which here, as in nature, is slower than that of the fingers, is derived from the centre pin of the joint G, passing through a slit or elongated eye in a rod hinged at the bottom, and on its prolongation above, carrying an eye, forming the joint H, from whence the steel tendon I, gives the second movement to the fingers as before. The bent finger-piece is also coupled with the end of the rod *c* by a short connecting piece, L. In some cases the rod B, which elongates the movement, may be dispensed with, and the universal joint E be connected directly with the joint M.

It is evident, from this construction, that the grasp will be equally firm in whatever position the hand be placed, either as it respects the bending of the wrist, or its rotary movement.

Fig. 4.



In the structures before described, a pressure or grasp between the thumb and fingers near their extremities is effected, and also the holding of substances of a moderate size near the middle of the hand; and, perhaps, this may in most cases be as much as is required where the person employing it has only lost one hand, and can, therefore, do any more difficult task with the other; but there are persons who have had the misfortune to lose both hands, in which case it is desirable to give this substitute all the efficient movements it is capable of. With this view, let the thumb piece, as at A, fig. 4, be furnished with a horizontal joint, capable of being screwed firmly against a spring plate, so as to create sufficient friction to prevent its turning with inconvenient freedom, (any required position may also be secured by a spring catch.) By means of this joint, the thumb can at any time be turned, as in the natural hand, out of the way of the grasp of the fingers, so that these may close round till they meet the ball of the thumb. This will enable many things to be held more conveniently and firmly than when the thumb meets the extended fingers at some intermediate point, and stops their further progress. To effect this greater range of the joints of the fingers, some little adjustment of the former plan is required. It may be effected many ways, but let the arrangement shown at B, fig. 4, suffice for the present to explain what is intended. And these movements being chiefly similar to those in fig. 3, will readily be understood, without further explanation, by reference to that figure. George Douseland can write, though with difficulty, with the hand as constructed in fig. 2, but an inventive young friend of mine has suggested the use of a spring movement in the last joint of the thumb, as at C, fig. 4, which will enable the pen to obey the pressure of the fingers backward in the down strokes; and to propel it forward in the up ones, as the fingers relax their force. This light elasticity of the thumb ceases when pressed back to its natural position by the joint being made incapable of receding further; and, hence, it will be no detriment to the firm grasp between it and the fingers.

To avoid confusion in the figures they are drawn so as to show the movement of one finger only; and in the hand worn by George Douseland there is but one such movement, all the cork fingers being united side by side, and fixed to one broad thin steel plate, jointed, as shown in fig. 2, and covered with continuous leather, only stitched down to mark the distinction of the fingers under it. For common use in most cases, this will be sufficient; but where a more expensive apparatus can be afforded, and the appearance of having a real hand is an object, this thin steel plate can be separated into digits, though united at the base as the human hand, and jointed at the proper places in due proportion to each finger; and the tendons piercing these plates, may be either hinged to fixed joints, as at S, fig. 2, or worked from a horizontal extension of the joint H, fig. 3. All the required movements can be effected by catgut or other tendons attached to the joints of the fingers, as in the natural hand, and terminating in loops or eyes, on different parts of such a hinged bar as F H, fig. 3, so as to give them different ranges of tension to suit their respective purposes. This structure implies the necessity of a counteracting worm, or other spring movement, to extend the fingers and thumb again. Very light and elegant hands may be made on this plan, which would be suitable for the fair sex, and for light work.

I before said, the first drawing made of the hand for George Douseland was on this plan; but I found that he could lift the weight of five stone with the stump, and that the strength, precision and durability of steel joints and tendons was more suitable to his work. These have also the great advantage of giving both extension and contraction, with no counteracting spring to weaken the effect. By one simple, lasting, and efficient means, both these actions are effected with perfect precision in all weathers.

This instrument, in all its forms, has only been represented as working when the spring bolt L, fig. 1, secured the lower arm from turning on the hinge F; but conceive this spring bolt occasionally drawn back, and secured from acting; and that a spring friction plate held the joint F, from turning, with less than three stone weight applied at the ring D by the stump, the grasp of the hand could then be used only up to that extent of pressure, sufficient, say, for example, to lift a can full of liquid; thus, if more than three stone force be applied, the friction of the joint will be overcome, the can will still be retained with the same power, but the movement of the joint will allow it to be lifted to the mouth. This is only one example of a very important principle, applicable to innumerable instances, which greatly increases the use of the apparatus.

The same principle may be carried out to a still greater extent in respect to convenient use, though not perhaps with so much power, by supplying the action of a strong spring in lieu of the friction plate. Let this spring be so arranged as to keep a nearly equal tension or pressure to retain the rods B and K, of the upper and lower arms, in a right line with each other, and to restore them to that position whenever the elbow joint is bent. By this means, supposing a glass, a

spoon, or other matter of light grasp be lifted to the mouth, as before described, it will not then be necessary to take it away from that position with the other hand as when the friction plate is used, for the reaction of the spring will continue the grasp, as the arm unbends by the downward movement of the stump.

Fig. 5.

One necessary aid to this instrument in all its forms is, to give support to its weight from the neck and shoulder; which, in the case of George Douseland is effected by a padded flat iron hook, surrounding a considerable portion of the neck, under the collar of the waistcoat, and passing behind it, so as to terminate on the shoulder, where it is cupped a little, to give it firmness of seat. To this part, the upper ring A of fig. 1 is attached by a couple of straps with buckles,—see fig. 5. By this means, the arm is not fatigued by the weight of the apparatus, and the joint F is at all times preserved in the same line of axis as that of the elbow joint, with which it has to move as on a centre common to both.

As the hollow ball and socket movement, previously suggested, will require very excellent workmanship to render it efficient, it will be as well here to remark, that with much coarser work the wrist movement may be effected by an external hoop, similar to H, fig. 1, containing a second, that can turn completely round freely within it, but confined from escaping by any of the usual means. The inside of this hoop should be cupped, so as to approach a section of the globular form; and a third hoop, externally, a similar segment of a globe, but a size smaller, must fit, without much nicety of adjustment, within the second. An axis passing through the centre of both these spherical portions is fixed to the inner one, but turns freely in a collar in the second the end being flush with its exterior surface. The ball and socket action, so far as it is used, is here derived from the one turning on an *axis* within the other, and not from the accurate fitting of these spherical portions. Any required position of the hand, which is attached to the inner ring, can be secured by a catch and holes to receive it, as before. On the centre of this axis, the tube D, fig. 4, may be fixed.

I am sorry to give you so many dry details, of no interest excepting to workmen, to whom, in fact, this communication is chiefly addressed, and without whose aid those who require the use of this instrument cannot procure it.

A much more simple and less costly hand than that worn by George Douseland, at the Polytechnic institution, might be made, chiefly of wood or bone, for poor persons; and I hope, that all good workmen,

who live by the use of their own hands, will, when called upon to make these humble substitutes for the poor man's *capital*, (for so, in fact, the hand is to him,) exercise a generous sympathy towards the sufferer.

London Mechanics' Magazine.

Anastatic Printing.

Early in October of 1841, we received from a correspondent at Berlin, a reprint of four pages of the *Athenæum*, (which contained three wood-cut illustrations,) published in London only on the 25th of September. As we stated at the time,—"The copy was so perfect a fac-simile, that had it reached us under any other circumstances, we should never have suspected that it had not been issued from our own office—and even with our attention thus specially directed to the subject, the only difference we could discover was, that the impression was lighter, and that there was less body in the ink; from which we infer that the process is essentially lithographic, the impression of the original page being, in the first instance, transferred by some means on to the surface of the stone or zinc plate. This, however, is but a conjecture, and our correspondent is unable to throw light on the subject. In reply to our urgent request for further information, he thus writes:—

"*Berlin, Nov. 25.*

"I have not ceased to exert myself to obtain the information you desire, but all I can collect is briefly this:—The process by which these fac-simile reprints are produced, was discovered by a gentleman at Erfurt, and is kept a profound secret. I have since seen a copy of an Arabic MS. of the thirteenth century, and of a leaf of a book printed in 1483, both of which have been produced without the slightest injury to the originals, so that your Bibliomaniacs may despair of ever again seeing a unique copy. The parties in possession of the secret are about to re-publish here the *Athenæum*, and are to commence operations with the first number of the coming year. I have seen the draft of the Prospectus, in which they offer to supply the trade at the rate of three thalers (9*s.*) per annum. They will be content too, I understand, with 300 subscribers, and from this fact, you may form a conjecture as to the probable cost of the process, which must be below what the mere paper costs you."

The copy we received was submitted by Lord Monteagle to the commissioners appointed to inquire into the Exchequer Bill forgeries, in proof of the difficulty of guarding against fraud by any mere typographical arrangement. From that time, we heard no more of this wonderful discovery. We now learn, that the discoverer was M. Baldermus, now of Berlin, and that the process has been communicated to Mr. Woods, of Barge-yard Chambers, Bucklersbury. Whatever may be the results of such invention, our duty is to record the fact, and throw such light upon it as the state of our information permits. Thus we learn, that the original to be copied is prepared by

peculiar chemical means, and pressed in tight contact with metallic plates, whereby a reversed fac-simile is obtained; and after the metallic plates have been prepared by a second process, (which prevents the adherence of ink on the blank spaces) the impression is inked up with rollers, and printed from in the usual manner of surface-printing. Eventually, the proprietors are sanguine of being able to print from cylindrical surfaces, and consequently produce an unlimited number in a short time. Both sides of a newspaper can be transferred simultaneously on contiguous cylinders. Nothing can exceed the ease, elegance, and rapidity of the whole operation. The specimen worked-off for us, a page of *L'Illustration, Journal Universel*, was produced in less than a quarter of an hour from the first preparation. In fact, allowing seven or eight minutes for the absorption of a dilute acid, the thing is done as quickly as two sheets of paper can be successively placed on a plate of zinc, passed under the roller, and again withdrawn. Such an agent as this is, it is obvious, of tremendous power; if abused, it is fraught with the most fearful consequences; under proper and legislative regulation, it may become the greatest of blessings. But such an instrument most certainly must not be suffered to work out its own issues without guidance and without law, solely at the caprice and uncontrolled motive of self-interest. It is inconsistent with our present social condition, and must either modify or be modified by it.

London Athenæum.

This mode of copying engravings and letter-press, appears to have nothing whatever of novelty in it. A specimen of the same thing will be found in Senefelder's original work on Lithography, printed in Sienna, 1818. In this country it has long been known and practised. The members of the Franklin Institute will scarcely need to have recalled to their recollection the engraved stone, with the specimens of copied letter-press, which were deposited in our hall, for public inspection, in October, 1839, by Mr. Joseph Dixon, of Taunton, Massachusetts. A mode somewhat similar has been employed, under the name of Zincography, in London, many years since. And during the excitement caused by the French Revolution, in 1830, the French papers were copied and a new edition issued in Brussels in a few hours after their arrival, by an analogous process.

We insert with this notice, the specimen sent to us by Mr. Dixon.

Com. Pub.

Nasmyth's Patent Steam Hammer.

Having, on several occasions, directed attention to Mr. Nasmyth's novel and ingenious invention, it must be interesting to our readers to be informed of its rapid and most successful progress towards general adoption, and which, we are glad to find, is giving the very highest satisfaction to all the parties who have availed themselves of so powerful and useful an assistant. One of the hammers was put in operation for the first time in Scotland, on Monday week, at the Dundyvan

The specimen of Transfer on the opposite page, – prepared for the Journal of the Franklin Institute, – was made in our presence this day, by Mr Joseph Dixon, from an Arabic work, printed in 1787.

Taunton Mas. Octr 28th 1839.

Marcus Morton

Francis Baylies. Henry Williams

James L Hodges. Andw Bigelow

يَمِينًا وَيَسَارًا وَهُوَ خَائِفٌ مَرْعُوبٌ فَنَظَرَهُ ٱلثَّعْلَبُ فَنَضَّ عَلَيْهِ فَقَالَ لَهُ ٱلْأَسَدُ نَبِّسْ مِنَ ٱلْحِرْذَوْنِ خَوْفِي إِنَّمَا أُكَبِّرُ عَلَى إِحْتِقَارِي ✡

هٰذَا مَعْنَاهُ ✡

أَنَّ ٱلْهَوَانَ عَلَى ٱلْعَاقِلِ أَشَدُّ مِنَ ٱلْمَوْتِ ✡

أَسَدٌ وَثَوْرٌ ✡

أَسَدٌ مَرَّةً أَرَادَ يَفْتَرِسُ ثَوْرًا فَلَمْ يَجْسُرْ عَلَيْهِ لِشِدَّتِهِ فَمَضَى إِلَيْهِ لِيَحْتَالَ عَلَيْهِ قَائِلًا إِعْلَمْ أَنِّي قَدْ ذَبَحْتُ خَرُوفًا سَمِينًا أَشْتَهِي أَنْ تَأْكُلَ عِنْدِي فِي هٰذِهِ ٱللَّيْلَةِ خُبْزًا

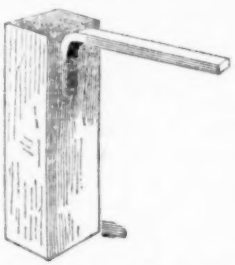
NOTÆ AD FAB. IV.

In ſpeluncam quandam] *Arabice* in quandam ſpeluncarum. *Obſervent autem ſtudioſi, vocem* بعض, *quæ collective paſſim accipitur,* & quosdam, nonnullos, partem *ſignificat, etiam ſingulariter interdum ſumi pro* احد & احدي *ſine ullo tamen generis reſpectu; ut hic* & *locis aliquot aliis in hoc opuſculo.*

لكبى *

Iron-Works, near Glasgow, and, as might have been expected, attracted a good deal of interest and public attention; its weight is nearly 2 tons 12 cwt., and the precision with which the patentee can direct, or control, at will, the power necessary for making a slab of half a ton of iron, or cracking a nut of an inch circumference, of shingling a bloom of iron, or shutting the lid of a snuff box—in short, of simply touching, or actually crushing, anything "from a needle to an anchor"—is the most convincing proof that need be adduced of the adaptation and consequent importance of this patent steam hammer.

There are upwards of thirty now in action in various parts of Europe, all of which are giving the highest satisfaction, and more than realizing the most sanguine hopes entertained of its practical value in facilitating the working of masses of wrought iron, as well as materially improving its quality. In respect to this subject, it may be interesting to some of our readers to know, that "puddled balls," hammered under this machine, have the cinder so entirely driven out, as to yield at once a quality of iron at least advanced an entire process—that is to say, the result, as to quality, of this first stage in the manufacture of wrought iron, is equal to that of the second—a fact that will be duly appreciated by those practically conversant with the manufacture of wrought iron. The facilities of "up ending," as it is termed—that is, of turning a mass of iron on its end, so that the *ends* of the mass may be hammered compact and flat, as well as the *sides*—is rendered so simple and easy a process under this hammer, by reason of the great range of fall which can be commanded at pleasure, that it is an advantage which appears to be highly valued by the iron manufacturers, as the entire material of the mass is in this way rendered available, when rolled out into a bar or boiler-plate. In the process of piling or welding the slabs of iron which go to form large boiler-plates, the most important facilities are obtained from the use of the steam hammer, not only from the vast energy of the blows serving to knock out, in the welding, all cinder and scoriæ by a few masterly and truly effective blows, but also by enabling the mass so produced to be turned upside ways, edge ways, and end ways, so as to be made into one compact rectangular mass—this being the natural result of the wide range of height of fall of the hammer, as well as the important fact of the hammer and anvil face being at all times parallel to each other. It is amusing to see the *kindly* way in which it pats a tender, spongy, puddled ball, and then, when it is ready and fit to receive a blow, to see the hammer "walk into it," in such style as to send the cinder squirting from its most inward recesses—the whole resulting in one compact neat mass of almost perfectly pure iron. But, when it is known, that Mr. Nasmyth has now in hand forty-eight steam hammers for various parts of Europe and America, such a fact speaks sufficiently well for its merits being appreciated.



Mining Journal.

Improvements in Coating Iron with other Metals.

We copy from the *Civil Engineer* the following notice of the patent recently obtained by Messrs. Morewood and Rodgers, for improvements in coating iron with other metals:—The first part of these improvements relates to a mode of coating articles of cast iron with tin or other metal. This part of the invention is confined to the combined process of casting iron in metal moulds, and then coating such articles with molten metal, the process being conducted by first cleansing the surfaces in the ordinary manner, and then coating them in a manner hereinafter to be described.

The second improvement relates to a mode of treating articles of iron before submitting them to the melted metal to be coated. In carrying out this part of the invention, the patentees provide an iron box, or trough, about seven feet long, and of sufficient width to contain the plates of metal to be coated; this box is provided with a number of ribs, or bars, so as to prevent the plates from touching one another; in the bottom of this box is placed sal ammoniac, to the depth of three or four inches; a fire is then lighted under the box, the heat of which causes the sal ammoniac to give off vapor to such a degree as to exclude all atmospheric air; after this process the sheets, or articles of iron, may be immersed in melted metal, for the purpose of coating them in any convenient manner.

The third part relates to a mode of treating tin which has become injured in the process of tinning. In coating iron with tin by the ordinary process there is considerable waste, owing to its passing through the oil or tallow employed in the tin bath; this part of the invention, therefore, consists in submitting the waste, or spoiled, tin to a red heat, and then allowing it to cool; after which it is to be placed in an earthenware vessel and covered with muriatic acid of commerce, which, in an ordinary temperature, must remain about two days, at which time the acid will have become sufficiently neutralised, and may then be drawn off; by this means the inventors obtain chloride of tin, which they employ in the process of tinning metal.

The fourth improvement relates to a mode of coating sheets of iron with lead, or alloys of lead and tin, the latter being in the proportion of (not exceeding) 15 per cent., by means of a flux, containing sal ammoniac and chloride of zinc without the aid of tallow. In carrying out this part of the invention, the patentees prefer to use a flux composed of three-parts of chloride of zinc, without any oil or other fatty matter; the sheets of iron may be dipped in the bath of molten metal in the ordinary manner.

The last part of these improvements relates to an after coating of lead or alloy of lead—that is to say, coating articles which may have received a previous coating of zinc or alloy of zinc. In the case of iron which has received a previous coating of tin or some other metal, and afterwards to receive a coating of zinc, the inventor proceeds by melting the metal in an iron pot, and then covering its surface with a suitable flux, which may be composed of two parts of chloride of

zinc, and about one part of oil or tallow; the articles to be coated are then to be immersed in the metal, and allowed to remain until they become of the same heat as the metal, (care being taken that the metal is not too hot, so as to melt the previous coatings,) they are then withdrawn, and shortly afterwards dipped into water, and then brushed with sawdust, to remove the flux. Ibid.

Improved Manufacture of Cast Steel.

Although it has long been known to chemists, that the only essential difference between cast iron and cast steel consisted in the relative proportions of carbon contained in the two substances, it has yet been found impracticable hitherto to produce the latter substance at a less cost than from four to eight times that of the pig iron from which it is made. For instance, if pig iron, made with charcoal and the relative materials suitable for the manufacture of steel, cost 6*l.*, it will be found, that according to the processes now universally used, cast steel cannot be made from such iron at a cost of less than 29*l.* per ton, in the ingot; and for the superior descriptions, the raw material of which bears a monopoly price, the cost of cast steel in the ingot, comes to nearly double this price. The cause of this cost arises from the great waste and labour necessary to deprive the pig iron, in the first instance, of the whole of its carbon, amounting to about 5 per cent., and to reduce it into malleable iron; this iron is then recombined with about 1 per cent. of carbon, in the process of cementation, forming blistered steel, and to produce cast steel it is necessary to melt the blistered steel in crucibles of fire clay and run it into moulds. If the cost of pig iron of medium quality, fit for making steel-iron, be 6*l.* a ton, the loss on converting it into bars is one-third, or 2*l.* more; the average cost of labor, fuel, and other charges, on making a ton of charcoal bars, will be 5*l.* more; the foreign merchant's profit, freight, insurance, import duty, and other charges, will be 4*l.* a ton more; the profit of the importers in this country will be 2*l.* a ton more; making the cost of bar iron, of medium quality, fit for making steel, 19*l.* a ton to the steel manufacturer here; in making this iron into steel, he incurs a further expense of 1*l.* 10*s.* for conversion into blistered steel, and about 7*l.* 10*s.* for making the blistered into double shear or cast steel in ingots; making the cost of these two articles of medium quality about 29*l.* a ton; and all this cost of 23*l.* a ton is necessary to get rid of the 4 per cent. of carbon in the cast iron, beyond the proportion required to form cast steel. It may be observed, that, by a recent improvement, cast steel can be made capable of welding to iron with the same facility as shear steel, and the manufacture of the latter article is rapidly giving place to the increased use of cast steel. Before this improvement, it was calculated that the quantity of cast steel annually made in England was about half the whole quantity of steel manufactured; at present it probably exceeds two-thirds of the whole quantity. The solution of the problem of producing cast steel direct from cast iron without incurring the enormous expense hitherto inseparable

from the old process, has engaged the attention of scientific men since the time of Reaumur, whose work appeared nearly a century ago, to the present time, without having produced any result of the least value. The process of making natural steel, or that of decarburating pig iron, to a certain extent in a charcoal refinery, and then drawing it into bars under the hammer, has been known for ages; and, for a long period, was the only known method of making steel in Europe; but the steel thus made is inferior to all other kinds that are manufactured, and its quality is such that it is not used in this country for any purpose whatever; even this inferior article, however, costs about three times the price of the pig iron from which it is made, and its price quoted in the Prices Current of the day, in bond for export, is about 17*l.* a ton. At length, however, this object is announced as having been accomplished by a gentleman, who states the apparent paradox, that he is able to produce cast steel at a cost not exceeding that of pig iron of a quality suitable for the manufacture of steel. Of the importance of such a discovery, supposing it brought into practical operation, some opinion may be formed, from considering that steel made in this manner may be sold at half the present selling price of that of medium quality, made in the usual way, at a profit of 100 per cent.; and that the quality of it, according to the statement of the discoverer of the process, will be equal to that now made from the most expensive foreign iron; it is also stated that the steel is suitable for every purpose for which steel is now used—from coach springs to surgical instruments—and that, consequently, this process must entirely supersede all those at present in use for making the various descriptions of steel now used in the arts. The quantity of steel of all kinds now annually manufactured in this country alone, is estimated at 25,000 tons; if the *average* value of all kinds of shear and cast steel in ingots be taken at 28*l.* a ton, the value of the whole quantity manufactured will be 700,000*l.*: if cast steel can be made by the new process, so as to admit of its being sold at half this price, with a profit of 100 per cent., there will be a saving to the public of 350,000*l.* a year, and a profit to the manufacturers of the steel, of 175,000*l.*

It is stated to us that a suitable material for this manufacturing steel may be had in great abundance in this country, and the manufacture can be carried on to any extent, commensurate with the increasing consumption, which will be the certain consequence of such an enormous reduction in price to the consumer, without being dependant, as the steel manufacturers of England have hitherto been, upon foreign countries for the supply of their raw material, and the scarcity of the best qualities of which has hitherto enabled the possessors of such material to obtain for it an enormous monopoly price. The steel made by the new process would all be of uniform quality, and trials on a large scale, even in this stage of the matter, have satisfied some of the best judges in this country, that it is impossible to surpass it as regards its quality.

M. Schafhaeutl's Method of Purifying Castings applied to the Moulding in Second Fusion.

[Abridged from the *Moniteur Industriel.*]

No metallurgist is ignorant of the process adopted by M. Schafhaeutl for refining sulphurous, phosphoric, and arseniferous castings: hitherto its success in Germany has been complete, and the method appears so simple and correct as to warrant the anticipation of the best results. The ingredients of his composition consist of 1¼ lbs. of peroxide of manganese, 3¾ lbs. of chloride of sodium, 10 ozs. of clay—the two last, of course, being the essential elements. The mixture being subjected to the temperature of a puddling oven, instead of volatilizing itself, decomposes; the sodium seizes the oxygen of the air or of the peroxide of manganese, and is transformed into soda, which unites with the silica and alumina of argine, and gives place to a silicate and aluminate of soda, which mix themselves with the scoriæ. The protoxide of manganese is converted afterwards into silicate, and thus diminishes the waste of iron; and the chlore being at liberty seizes on the sulphur, phosphorus, and arsenic, to form volatile chlorures, which escape by the chimney. We see, therefore, that the process has the effect, not only of purifying the castings, but, probably, of materially shortening the labor; and it is a question, whether, by a slight modification, it might not be adapted to the purifying castings for moulding in second fusion. But, for this it will be necessary, in the first instance, to lessen the proportion of peroxide of manganese. In fact, the contact of the metals with oxygen is wholly unnecessary, decarboration of the castings not being intended, and as to the oxidation of the sodium, the current of air produced by the pipes is more than sufficient for that purpose. But, in applying the principle to the system in question, scoriæ were generated to a great extent, and the clay used in M. Schafhaeutl's, unfortunately does not tend to diminish this difficulty, but rather creates others, waste, trouble, &c. But, then, how are we to produce decomposition in the marine salt? If we substitute hydro-chlorate of ammonia, we shall have, first, the advantage of its salt being richer in chlore than marine salt; secondly, its requiring a far lower temperature to get volatilized; thirdly, the sal ammoniac being very easily decomposed by the iron; fourthly, the hydro-chlorate of ammonia does not augment the scoriæ; and, lastly, it contains from seven to eight per cent. of hydrogen, which would render the purification more complete; the only objection to this is the difference of price between the ammoniac and the marine salt. The question, then, is, would that objection be compensated by the undeniable advantages of the substitute? To purify the castings of sulphur, chlorine of sodium must be largely used; but this, and the difficulty of cooling, is overcome by the sal ammoniac, for the latter considerably raises the temperature of the furnace; and if this be established, we know nothing to prevent iron-masters from purchasing hydrochlorate of ammonia at a low rate, and then applying the carbonizing ovens, they would thus procure more sal ammoniac than they

could possibly use. But, though this substitution may thus be beneficial in the cupolas, we doubt if it would be so in the reverberating furnaces, as in the latter the intimate contact of the sulphurous casting with the sulphurating matters, exists only by a stirring about, more or less prolonged; and this stirring, a *sine qua non* condition of a sufficient renewing surface, may, if great care be not taken, occasion great inconveniences; the casting exposed on a large surface to the action of the air, drawn by the flame, will partly refine itself, or, at least, whiten; this, however, may be obviated, we think, by the admixture of a small proportion of carbon, which will preserve, as much as possible, that which constitutes the casting; thus, then, we have freely given the various advantages and objections which are prominent in the application of M. Schafhaeutl's system to the purification of castings in second fusion, by the substitution of hydro-chlorate of ammonia; it remains to be proved whether its benefit will counteract the difficulties which present themselves. The suggestion, however, is at least valuable, and we shall anxiously watch its issue. Ibid.

On the Mean Year, or the Solar Variation of the Barometer, in the climate of London. By Mr. Luke Howard.

Mr. Howard exhibited curves which showed the mean annual pressure and temperature, and the quantity of rain, during a cycle of eighteen years. This period he conceived long enough to eliminate the lunar influence which meteorologists had for some time been willing to admit the existence of, and to exhibit that of the sun alone. The development of Mr. Howard's views depends so much on explanations in detail of the diagrams, that it is not possible for us to give them. The observations seemed to show a succession of nine warm and nine cold years, with—as might be expected—occasional irregularities and similar successions in respect of rain, but with a cycle of only half that duration. In the annual curves, deduced from the monthly means of the whole period, much greater uniformity is observed, and both the rain and barometric pressure follow more closely the march of the temperature.

The Rev. Dr. Robinson expressed a hope that these speculations of Mr. Howard might be confirmed, or rendered more precise, by the extensive observations now established at Kew. He could not help regretting, however, that Mr. Howard had not conjoined the state of the wind and hygrometer; as it was obvious from Colonel Sabine's paper on the Meteorology of Toronto, that the latter was intimately connected with barometric indications, while it was equally plain, that the former influenced the amount of rain.

Proc. British Assoc.—London Athenæum.

Transactions of the Paris Academy of Sciences.—Dec. 23.

Messrs. Elie de Beaumont and Dufrenoy presented a lithographic map printed in colors by a new process, discovered at the Royal Printing-office of Paris.—A letter was received from M. de Humboldt,

stating that M. Ehrenberg has just made some new discoveries of infusoriæ still more wonderful than any he has hitherto announced.—A paper was received from M. Pirsis on the relations that exist between the configuration of continents and the direction of the chains of mountains. He finds that, in general, the coasts are parallel with the chains of mountains.—M. Arago presented, in the name of M. Aimè, two instruments, one to ascertain the direction of submarine currents, the other to measure their speed. These instruments were accompanied by an account of several experiments which had been made with them. It states, amongst other things, that the greatest speed of the currents on the coasts is on the coast of Africa between Algiers and Bona, and not, as is generally supposed, between Gibralter and Algiers, and that in the Straits of Gibralter there are three parallel currents. Near the coasts the direction is from east to west, whereas the central current proceeds constantly from the west to the east; the latter is 7 miles wide between Trafalgar and Cape Spartel. The width of the strait, at its narrowest part, is 12 miles; between Trafalgar and Cape Spartel, it is 27 miles; and 15 miles between the Point of Europe and Ceuta.—M. Pouillet gave an account of some experiments, to ascertain the rate of rapidity of electricity and the explosive speed of gunpowder. As may be supposed, the rapidity of the electrical current is found to be almost incalculable. As regards the rate at which the explosion of gunpowder proceeds, he has ascertained that the time which elapses between the snapping of the capsule of a gun-lock and the departure of the ball from the barrel is the one hundred and fortieth part of a second. The electrical current would hardly be the three thousandth part of a second in performing the same distance.—In a letter from M. Jobard, of Brussels, that gentleman states that, when at Munich, he observed that the stone staircase of the bronze obelisk to the memory of the Bavarians who fell in the campaign of Russia was perfectly free from green mould in the parts washed by the rain. He is of opinion, that the oxide of the copper carried down with the rain destroys this vegetation; and recommends that a solution of copper should be tried in the cleaning of statues covered with vegetable matter.

Jan. 6.—Several communications were received of real or imaginary improvements in railway traveling.—In a former notice, we mentioned an apparatus, by a M. Chuart, the object of which is to indicate the danger from fire-damp, or the escape of gas. M. Chuart's invention consists of a globe, or ball, contained in a chemical solution highly sensible to any deterioration of the atmosphere, and acting upon a lever, which sets an index in motion, and thus shows the vitiated state of the atmosphere, whether in a mine, or elsewhere, long before the common air can be so saturated with gas as to explode on the application of a light. M. Chuart has added to his invention an alarum bell, which is struck by the lever when the ball is thrown off its equilibrium by the vitiated state of the atmosphere. Since M. Chuart first exhibited his apparatus he has made a great improvement. His ball was originally of glass, which was not only too heavy, but also liable to breakage. He now makes it of copper, so very thin that its weight

is almost nominal, and yet it is perfect in every part. We understand that he arrived at this perfection by means of the galvanic process, which gives a thinner substance than any mechanical means could effect consistently with the compactness that is required for the certain operation of the apparatus.—A paper was received from the Abbé Cochet, on the disappearance of the vine from Normandy.—M. Lewy made a communication, stating that he has analyzed several descriptions of wax obtained from different sources, and all of which, he says, have an affinity more or less to bees'-wax. He concludes that bees do not produce wax from any natural process of their own, but merely collect it.—A communication was received, announcing that the Abbé Baldacconi, conservator of the Museum of Natural History of Sienna, has discovered a means of petrifying animal substances. The process consists in the immersion of the substance to be hardened, for a long time, in a strongly charged solution of twelve parts of bichloruret of mercury, and one or two parts of hydrochloruret of ammonia. By this process, the natural color of the objects is preserved, which is not the case if the bichloruret of mercury be used alone. With the letter announcing this fact, was forwarded the liver of a dog, preserved, retaining its natural form and color.

Jan. 13.—A communication was made of the discovery of a comet, at Berlin, on the 28th ult., by M. d'Arrest.—A letter was read from Mr. Maclean, of the Cape of Good Hope, announcing that he had seen there, in October last, the comet discovered by M. Mauvais, and which was no longer visible in our atmosphere.—A letter from M. Le Bœuf informs the Academy that there is in Chili, the country of the Peruvian bark, a plant which is esteemed its equal, but is very little known in Europe. It is the canchalagua.—The following curious letter was received from a wood-cutter, named Terebolf, of Brionne:—Since it appears to be the fashion to make the Academy acquainted with everything at all extraordinary that is witnessed for the first time, a poor wood-cutter may be permitted to communicate an observation, which has certainly been made also by several of my comrades, but which I have some reason to believe will be entirely new for Messieurs les Académiciens. I have remarked that whenever a flock of sheep passed near the place where we were occupied in stripping the oaks of their bark for tan, it was absolutely impossible for two or three hours, and by the means which we usually employ, to strip off the bark of a diameter of more than three or four centimètres. My comrades attribute this strange fact, which I remarked for the first time more than five years ago, to the volatile sweating of the sheep, which has the property of coagulating instantaneously the sap near the bark, and to prevent its free circulation for two or three hours.

Athenæum.

ERRATA.

Page 13, line 2, for "teeth" read "tubes."
" " 10, " "Shelly" " "Shelby."